REPORT RESUMES

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EDUCATIONAL DATA PROCESSING--A CURRICULAR ANALYSIS WITH THE ORANGE COAST COLLEGE PROGRAM IN PERSPECTIVE.

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THE DATA PROCESSING TECHNICIAN SHOULD BE COMPETENT IN SYSTEMS, APPLICATIONS, AND METHODS. RECENT TRENDS HAVE EMPHASIZED COMPUTER TECHNOLOGY, WITH UNIT RECORD EQUIPMENT USED ONLY AS SUPPORT. PROGRAMS IN DATA PROCESSING TECHNOLOGY MUST INCLUDE BOTH THEORY AND APPLICATION, WITH BREADTH TO PROVIDE A BASIS FOR LATER ADVANCEMENT AND SPECIALIZATION. A PROGRAM DEVELOPED AT ORANGE COAST COLLEGE TO PROVIDE SUCH A COMBINATION HAS BEEN REVISED TO KEEP PACE WITH OCCUPATIONAL DEVELOPMENTS. A PILOT HIGH SCHOOL DATA PROCESSING PROGRAM WAS DEVELOPED BY THE COLLEGE AND THE LOCAL HIGH SCHOOL. THE MAJOR PORTION OF THE DOCUMENT IS A DESCRIPTION OF THE PROGRAM--STAFF, FACILITIES, TEXTS, CATALOG DESCRIPTIONS, AND DETAILED COURSE OUTLINES. (WO)

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EDUCATIONAL DATA PROCESSING: A CURRICULAR ANALYSIS WITH THE ORANGE COAST COLLEGE PROGRAM IN PERSPECTIVE

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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UNIVERSITY OF CALIF.
LOS ANGELES

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CLEARINGHOUSE FOR
JUNIOR COLLEGE
INFORMATION

A Seminar Report
Presented to

The Faculty of the School of Education
University of California at Los Angeles

In Partial Fulfillment

of the Requirements for Education 261D

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March 11, 1967

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EDUCATIONAL DATA PROCESSING: A CURRICULAR ANALYSIS WITH THE ORANGE COAST COLLEGE PROGRAM IN PERSPECTIVE

> An almost unbelievable shortage of competent data processing personnel exists in the areas of qualified managers, analysts, and programmers.[1]
>
> More than forty percent of all data processing installations in the United States are failures. Of these, more than ninety percent survive by crisis.[2]
>
> No industry has taken a tool of such unparalleled power and used it so badly.[3]
>
> ...data processing management personnel themselves are incompetent -- as managers, not as technicians.[4]

Strong statements? All of us who are alert to the complexion of the times are aware that the methods of counting, recording, classifying, sorting, summarizing, and communicating of data have been constantly and rapidly changing.[5] We are vitally aware of such terms as automation...computers...data processing...and systems. The organization whether it be categorized business, educational, or governmental, is immersed in a creatively destructive evolutionary technological process. This process, which is spurring organizations carries with it a mandate for education and educational support.

Statement of the Problem. It is the purpose of this paper to develop a perspective of curricular trends in educational data processing at the junior college within a chronicalization of a resume and forecast of the Orange Coast College program.

Background of the Problem. As a result of an educational and occupational survey of Orange County conducted jointly by Fullerton, Santa Ana, and Orange Coast Colleges the trend toward automation in business within the county was validated. With the support of the Bureau of Business Education, a data processing advisory committee was selected in 1958 which was composed of members of aircraft, food processing and handling, insurance, electronics, precision instrument companies, and civic agencies. This advisory committee was to become the chief resource group to assist Orange Coast College in establishing a business data processing curriculum under the provisions of the National Defense Education Act of 1958, Titles V, VII, and VIII.[6]

The initial questions for which solutions were sought by the advisory committee in 1958-1959 are listed below:[7]

1. What is a data processing technician?
2. Is there a need for this technician sufficient to warrant the establishment of a new training program?
3. What technical training will be necessary to adequately prepare the student to enter this new field?
4. What new subjects will be needed and who will teach them?
5. Who will be qualified to enter the program and will a sufficient number to justify offering the new program?
6. What kinds of equipment and laboratory facilities should be provided to adequately carry out these programs?

The explanatory development of the trends and perspective of Orange Coast's program can best be couched in answers to these questions posed by the advisory committee. The effect of answering these questions with the Orange Coast College program as a backdrop is brought out in this quote from DATA PROCESSOR the official journal of the Society for Automation in Business Education.[8]

> There is also a wide variety of curricular patterns that vary from state to state, town to town and school to school. For the most part, however, the comprehensive vocational programs of today have been patterned after the computer programmer curriculum developed about 1961 at Orange Coast College in Costa Mesa, California....Adaptations of this program have been made by schools throughout the United States.

CHAPTER I

WHAT IS A DATA PROCESSING TECHNICIAN AND IS THERE A NEED FOR THIS TECHNICIAN SUFFICIENT TO WARRANT THE ESTABLISHMENT OF A NEW TRAINING PROGRAM?

The initial description of a data processing technician as spelled out by the Orange Coast College Data Processing Advisory Committee was stated in the following fashion:[9]

1. A person who concentrates his efforts in the direct application of the functional aspects of business data processing rather than operations research or design of machines or systems.
2. The technician should have sufficient knowledge and experience in the operation of data processing equipment to utilize it in carrying out his duties. Manipulative skill and speed in operating this equipment will no doubt be helpful to the technician. ....many technicians will often find entry positions in the field as machine operators.
3. The technician's job will probably consist of non-routine duties requiring a technical knowledge of business data processing. He should be a specialist in data processing systems, methods, and applications. His technical knowledge should include:
    - A. The ability to interpret and construct flow charts.
    - B. The ability to do systems analysis (usually under the direction of a systems engineer).
    - C. The ability to write technical procedures.
    - D. Knowledge of the principles of control panel wiring.
    - E. Knowledge of computer coding principles and practices.
    - F. Knowledge and experience in computer programming.
    - G. Knowledge and experience in card layout and forms design and control.

This description is still reasonably accurate. However, the pendulum has swung from unit record operation to computer technology, with unit record hardware used only as support. Over the past couple of years there has been a drift from extreme emphasis on unit record equipment, and an emphasis has developed toward the computer performing operations previously reserved for unit record equipment. IBM 360 Model 20 for example which rents for slightly more than the standard unit record installation, gives you unit record abilities plus the capability of the computer thrown in.

That there is a significant difference between a hardware oriented systems analyst and a "general systems analyst" has been recognized much to the dismay of many organizations is another destinction which has become clear over past years. The procedures analyst we knew of during the 1940's and 1950's is not the hardware analyst needed today. The problems generated in many installations today are caused by the "theoretical" analyst who, instead of staying in his own field, has attempted to bridge the gap without proper training. This condition has been aggravated by management ignorance regarding the necessary qualifications of data processing personnel.

The burgeoning technology, the scramble toward the development of appropriate programs, the need for in-service training for management, have placed us in a technological revolution equivalent to the industrial revolution. For example, the need for computer programmers will increase 250% within the next six years. By 1970, it is predicted that the total market for computers will be over ten billion dollars. Figures for the last ten years show a steady one billion dollar a year increase in annual computer investment. Also, 1965 showed an increase of two and one half billion. Even forgetting exceptional years, the value of computers by 1989 would be twenty billions a year and by 1990 over 30 billions. By the end of the 1970's the number of computer installations will at the present rate, at least double.[10]

International Business Machines Corporation reports that needed today are 80,000 programmers, 60,000 analysts, and 100,000 other supporting personnel. In ten years the need for programmers alone is expected to rise to over 175,000.[11]

The Orange Coast College decision to offer an experimental course in data processing during the spring 1959 semester has been validated. The first course was designed for those already employed in business data processing to help them expand their knowledge and to give them a chance to improve on-the-job skills. The first instructors also were drawn from business. This course was critically evaluated and it was decided to initiate a two year Associate in Arts degree program starting in the fall of 1959.

In retrospect, a simple additional way to validate this decision is to look at the want ad section of your next Sunday's Los Angeles Times.

CHAPTER II

WHAT TECHNICAL TRAINING WILL BE NECESSARY TO ADEQUATELY PREPARE STUDENT TO ENTER THIS NEW FIELD AND WHAT NEW SUBJECTS WILL BE NEEDED AND WHO WILL TEACH THEM?

Let us first examine the purpose of the various types of training in data processing that are possible at the college level. Data processing education can be offered in technical schools, junior colleges, and four year colleges. Lets look at the possible training this way:

Conceptual Educational Philosophy

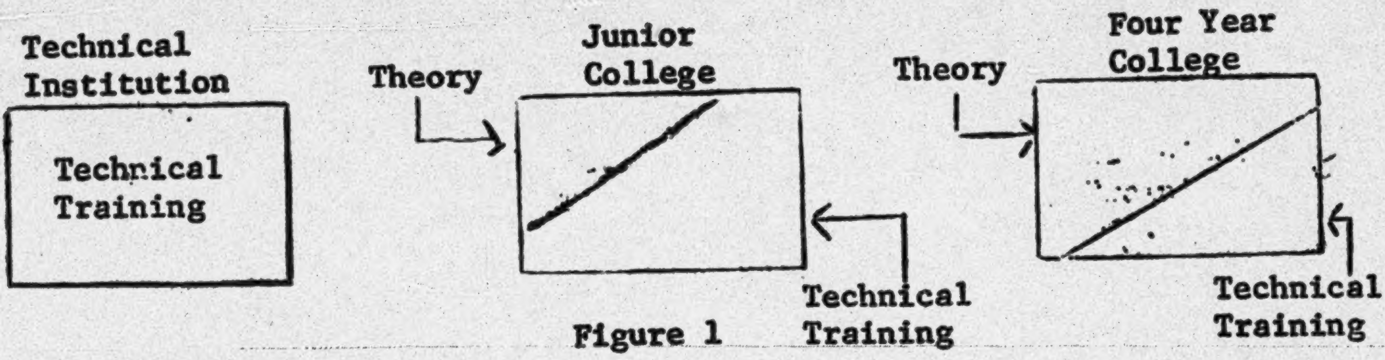

Technical Institution
Technical Training
Theory
Junior College
Technical Training
Theory
Four Year College
Technical Training

Figure 1

A technical institution can provide quick and immediate occupational training. The problem is that the training is narrow, possibilities for advancement are limited, and the possibility of technological obsolescence is greater.

The junior college can provide a combination of theory and technical training which will allow the student "head room" to grow, increase his ability to communicate with management and his ability to work within the organization. For those students who continue their education this type of training provides a very solid base from which to work.

The position of the four year institutions has traditionally been provision of management personnel. Looking at figure 1 the value of the junior college program in relation to the other two can be easily seen. Though junior college courses are only two years in length the student has a solid foundation on which to build, and communication between company personnel, i.e., management, supervision, and operation seems more logically facilitated.

Let us look at the hierarchy of educational objectives available to one pursuing a career in data processing. Figure 2[12] exemplifies that hierarchy.

HIERARCHY OF DATA PROCESSING OPPORTUNITY

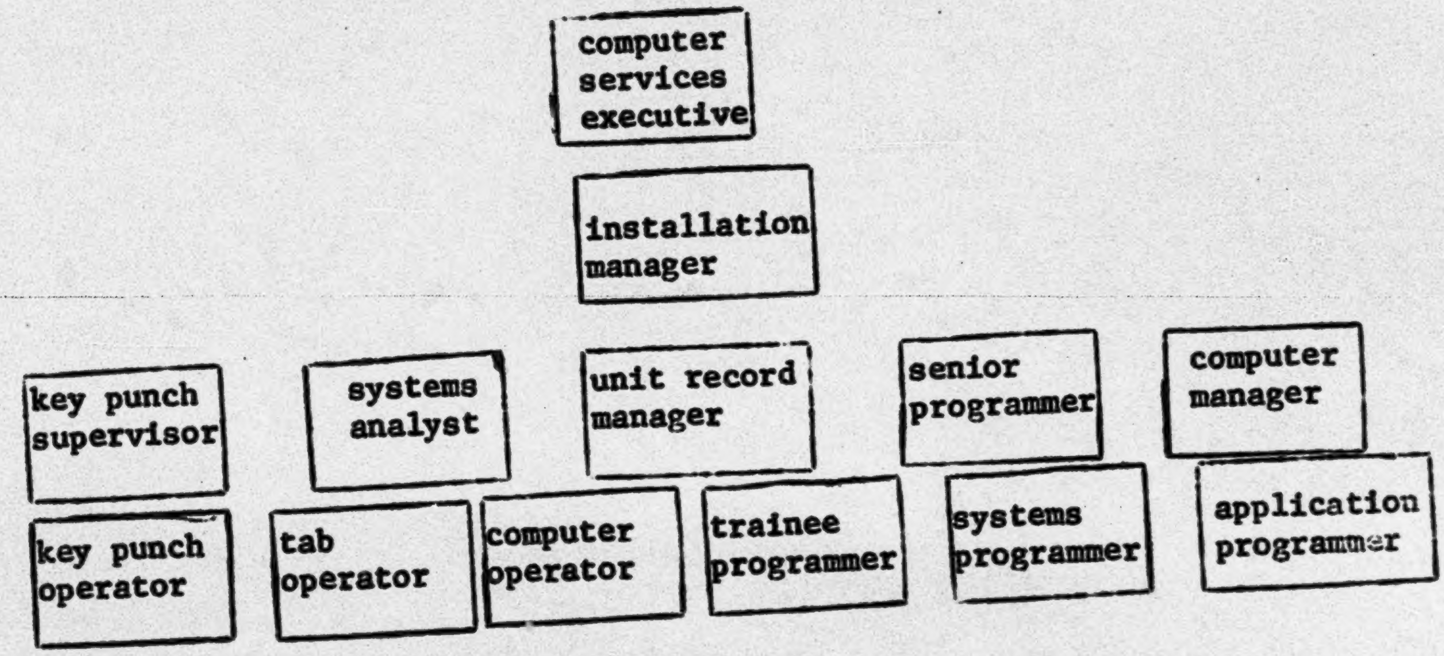

computer services executive
installation manager
key punch supervisor
systems analyst
unit record manager
senior programmer
computer manager
key punch operator
tab operator
computer operator
trainee programmer
systems programmer
application programmer

Figure 2

Figure 3 [13] below depicts the multifaceted choices available in what might be called a total data processing curriculum.

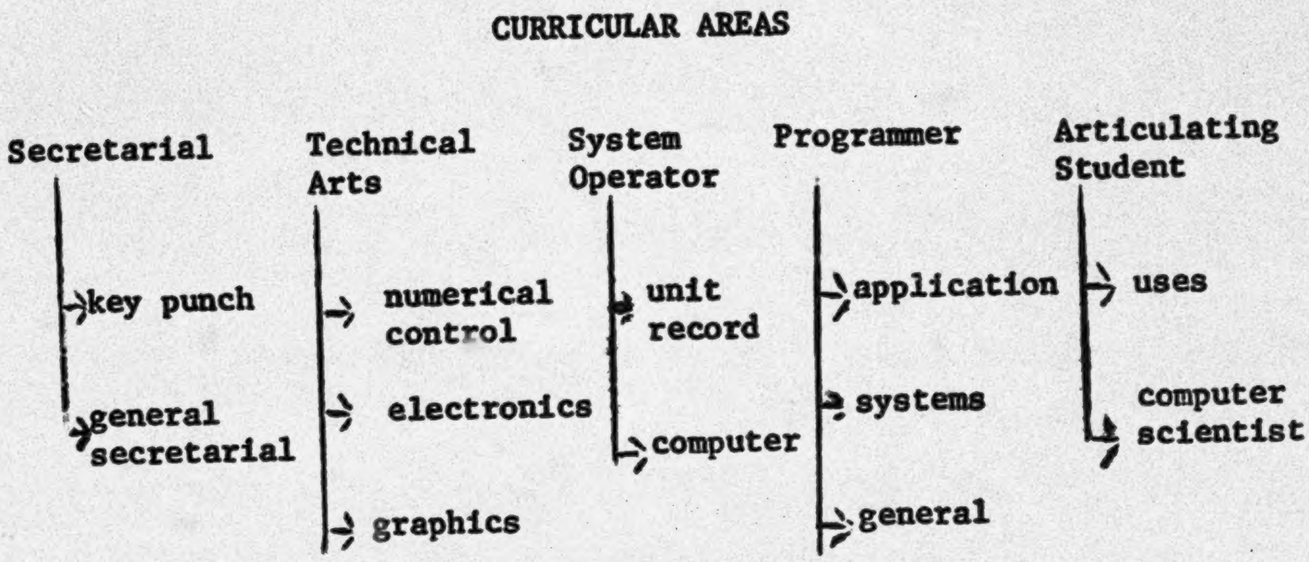

CURRICULAR AREAS
Secretarial
key punch
general secretarial
Technical Arts
numerical control
electronics
graphics
System Operator
unit record
computer
Programmer
application
systems
general
Articulating Student
uses
computer scientist

Figure 3

What new subjects will be needed? Figures 4 and 5 set forth both the curriculum initially established at Orange Coast College [14] and the requirements as they are today. Course descriptions of the present curriculum are detailed in Appendix A.

SUGGESTED TWO-YEAR PROGRAM

First Year	Units	
*B.E. 1A-1B Principles of Accounting	4	4
B.E. 5 Introduction to Business	3	-
*B.E. 2 Business Data Processing	-	3
Math 11 Introduction to Statistics	-	3
Psych 1A Psychology	3	-
English 1A-1B or 50A-50B	3	3
Social Science 10-12	2	2
Physical Education	1/2	1/2
	15-1/2	15-1/2

Second Year	Units	
+*Math 32A-32B Introductory Mathematical Analysis for Business	3	3
*B.E. 6A-6B Electric Accounting Machine Programming	4	4
*B.E. 7 Data Processing Systems	3	-
Math 35 Math and Logic of Electronic Data Processing	-	3
B.E. 8 Computer Programming	-	3
B.E. 86A Work Experience	-	2
Elective (see note)	3	-
Health and Hygiene	2	-
Physical Education	1/2	1/2
	15-1/2	15-1/2

*Required for Business Data Processing major.

+Math D, Intermediate Algebra and Math 3A, Analytic Geometry and Calculus may be substituted for the Math 32A-32B sequence.

Suggested electives include business management, physics and electronics courses.

Figure 4

The above curriculum was adopted February 3, 1959.

1966-67 CURRICULUM

FIRST YEAR

Fall

	Units
*Accounting 1	4
*Data Processing 1 (Introduction to data processing)	3
Mathematics 33	3
Bus. Mgmt. & Retail 1	3
Psychology 1a	3
Phys. Education	1/2
	16-1/2

Spring

	Units
*Accounting 2	4
*Data Processing 51 (Machine Wiring)	3
*Data Processing 61 or Beg. Programming .Math 7	3
English 50A or 1A	3
Health Education 1	2
Phys. Education	1/2
	15-1/2

SECOND YEAR

Fall

	Units
*Data Processing 62 Adv. Programming	3
Accounting 61	3
Mathematics 11, Economics1A or Econ. 5	3
English 50B or 1B	3
History 10 or 70	3
Phys. Education	1/2
	15-1/2

Spring

	Units
Data Processing 63 Prog. Systems	3
Data Processing 2 Systems.	3
Data Processing 81 Work Experience	3
Data Processing 83 independent Projects	2
Political Sci. 12 or elective	3
Phys. Education	1/2
	14-1/2

*Required for Certificate of Achievement in Electronic Data Processing (23 units). (This certificate is awarded without completion of AA degree for those who desire skills training only).

Figure 5

COMPARATIVE ANALYSIS BETWEEN 1958 - 1959 CURRICULUM AND 1966 - 1967 CURRICULUM

1958-59 Course No.	Course Title	1966-67 Course No.	Course Title	Offered 1966-67 Yes	Offered 1966-67 No
BE 2	Introduction to Data Processing	DP 1	Introduction to Data Processing	x	
BE 6A	Machine Wiring	DP 51	(6A 6B Combined) Machine Wiring	x	
BE 6B	Machine Wiring				x
BE 7	Systems and Procedures	DP 2	Systems and Procedures	x	
BE 8	Programming	DP 61	Beginning Programming	x	
		DP 62	Advanced Programming	x	
BE 86A	Work Experience	DP 81	Work Experience	x	
		DP 63	Computer Programming Systems	x	
		DP 83	Data Processing Projects	x	

Note: Only courses offered in the department of data processing are compared.

An analysis of the curriculum changes indicate a change in emphasis in technical training necessary for entry level positions. Also pointed out are additions to the curriculum which have broadened its training base through experience and experimentation.

The machine wiring course has been condensed to one semester, i.e., from the BE6A-6B series in 1959 to DP 51 in 1967. This change is due to a swinging away of unit record equipment as primary installation hardware and its implementation as support equipment to computer installations. The combining of the courses became possible in 1967 when the 602 calculator was returned to IBM due to the feeling of the staff and advisory committee that it was rapidly becoming technologically obsolete.

With the rapid development of sophisticated computer software DP61 and 62 were established to provide a two semester programming series. This duration is necessary to provide development of programming technique in the first course along with sophistication in machine language programming and an exposure to FORTRAN*. The second programming course develops competence in the use of assembler and compiler languages.

Also, a course in computer programming systems, i.e., such sophisticated manufacturer provided software as input-output control systems which require depth of study if one is to become a systems programmer are taught.

A course, DP83, was developed which allow each student to apply principles and techniques learned in previous courses to all of the hardware in the installation, and to gain experience in solving

[illegible] guage.

---

*Formula translator, a machine independent macro compiler language.

scientific and/or commercial dataprocessing problems. A complete course of study is detailed in Appendix A.

Who will teach them? One of the most challenging problems facing the junior college in starting the new program was that of staffing. An important initial source of instructors was business and industry where individuals with experience in the field could sometimes be wooed, if not by imposing salaries, by a desire to assist in developing a new educational program. Another source was business education and mathematics departments. Instructors already on the staff who had curiosity and interest in the field of business data processing were sent to night classes, summer classes and workshops.[15]

One fine source of instructional personnel was an eight week summer institute held during the summers 1963, 1964, 1965 to retrain office education and mathematics teachers in the teaching of business electronic data processing.[16] The institutes were of a two summer duration with only the second year institute being taught in the summer of 1966. Actually five institutes were held throughout the United States under the auspices of the federal and state departments of education with the west coast institute being held with Orange Coast College as sub-contractor to California State College at Fullerton who assigned eight units of credit to each institute. Dr. Norman Watson, District Superintendent of Orange Coast Junior College District was principal investigator for the western institute. It seems unlikely that the institute in California will continue in the summer of 1967 as the California State Department of Education will be unable to aid in financing the program.

The following is a list of the current staff in the data processing program at Orange Coast College. It is interesting to note that much of the strength of the staff stems from the summer institutes.

ORANGE COAST COLLEGE 1966-67 DATA PROCESSING STAFF:

Mr. Richard Brightman - A.A. - Orange Coast College
A.B. - Stanford University
M.B.A. - Stanford University
Participant 1964 summer institute
Instructor 1967 summer institute
Director, Educational Data Processing
Orange Coast College

Mr. Gilbert Saunders - A.A. - Compton College
B.A. - San Jose State College
M.A. - Stanford University
Four years of sales experience in data processing equipment
Instructor in 1963 & 1964 data processing summer institute at Orange Coast College.

Mr. Donald McKee - B.S. - University of California, Los Angeles
M.B.A. - University of California Los Angeles
Four years sales experience in IBM
Instructor in 1963, 1964, and 1965 data processing summer institute at Orange Coast College.

Mr. Bernard Luskin - A.A. - Long Beach City College
B.A. - Los Angeles State College
M.A. - Long Beach State College
Industrial experience in accounting
Participant in the 1963, 1964 summer institute.
Instructor in 1965 data processing institute at Orange Coast College.

Mr. John Clark - B.S. - Ottawa University
B.A. - Ottawa University
M.S. - University of Kansas
M.A. - Harvard University
Graduate Study - Southern Illinois University, Kansas State Teachers College.
One year experience in computer programming.

Mr. Richard Reynolds - B.S. - New York University
M.B.A. - New York University
18 years experience in business, including systems and management consulting managerial positions
Attended and instructed in 1965 data processing summer institute at Orange Coast College.

Mr. Donald Mundinger - B.B.A. - University of Wisconsin
7 years teaching experience
4 years cost accounting - Robershaw Fulton in Anaheim

Miss Sally Hiroaka - A.A. - Orange Coast College
B.S. - Long Beach State
Three years lab assistant and tab operator at Orange Coast College
Student teaching Costa Mesa High and Orange Coast College
Participant 1965 summer institute

Mr. Robert Bise - A.A. Ventura College
B.S. University of California Los Angeles
Gen Sec. San Jose State
M.B.A. University of CAlifornia Los Angeles
3 years high school instructor
2 years business experience
Particpant 1965 summer institute.

Mr. Theordore Tilton - A.A. - Compton College
B.A. - California State College at
M.S. - Rutgers University
Instructor in 1963, 1964, and 1965 data processing summer institute at Orange Coast College
Four years experience computer programming.

CHAPTER III

WHO WILL BE QUALIFIED TO ENTER THE PROGRAM AND WILL A SUFFICIENT NUMBER TO JUSTIFY OFFERING THE NEW PROGRAM ENTER?

Statistics obtained from the Office of Admissions and Records at Orange Coast College indicate the following:

DATA PROCESSING STUDENT ANALYSIS

Semester	Number enrolled as Data Processing Majors in day college	Number enrolled as Data Processing Majors in evening college	June Graduates
Fall 1959	26 (1.1% of total day enrollment)		
Fall 1960	58 (2.2% of total day enrollment)		None
Fall 1965	186 (2.5% of total day enrollment)	125 (1.17% of evening college enrollment)	20
Fall 1966	167 (2.7% of total day enrollment)	134 (1.3% of evening college enrollment)	36

Also the Orange Coast College Research Office indicated that of the thirty-six 1966 graduates, twelve transferred to other institutions and fourteen were occupational graduates. Also, twenty-two certificate of achievements, for example, were awarded in June of 1965.

The complexion of the student body in the Department of Data Processing is generally made up of (1) entering high school graduates interested in studying data processing, (2) individuals with experience in industry interested in upgrading their skills and re-training, (3) career army personnel stationed for a two year period at Orange Coast College for training in data processing.

A pilot program in high school data processing was developed cooperatively between Orange Coast College and Costa Mesa High School during the 1964-65 school year. The program has been very successful and interested students who complete the high school program and receive the recommendation of their instructor, who, incidentally is a graduate of the Orange Coast College summer institute program, are allowed to take a screening examination which has been developed within the Department of Data Processing. A satisfactory score on the examination allows the student to skip the introductory course and proceed immediately to the programming and wiring courses within the curriculum. This has been a very satisfactory arrangement.

Also, working with the Office of the Adjutant General of the Army a running complement of about forty select army personnel are stationed on a rotating basis at Orange Coast for training in data processing. About twenty personnel complete the program each year. Numerous members of each completing class have received commissions and graduates of the program are now stationed all over the world. The feedback from the army and from the students themselves has served to exemplify the strength of the program.

Since many of the army personnel who come to Orange Coast have had significant data processing experience the screening examination allows them an opportunity for waiver of the introductory course on an objective basis and relieves the data processing staff of making subjective judgments regarding an entering student's background.

Many students, especially evening college adults, find jobs in data processing before they progress very far in the sequence of classes. I have had as many as six or seven obtain programmer trainee positions after completing only the first programming course. Most of these are adult students who already have obtained substantial business experience.

CHAPTER IV

WHAT KINDS OF EQUIPMENT AND LABORATORY FACILITIES SHOULD BE PROVIDED TO ADEQUATELY CARRY OUT THESE PROGRAMS?

The equipment in operation at the present time in the Orange Coast College Program is listed below:

Computers:

IBM 1401 Computer - Model B, with Disc File
IBM 1620 Computer with Disc File

EAM Equipment:

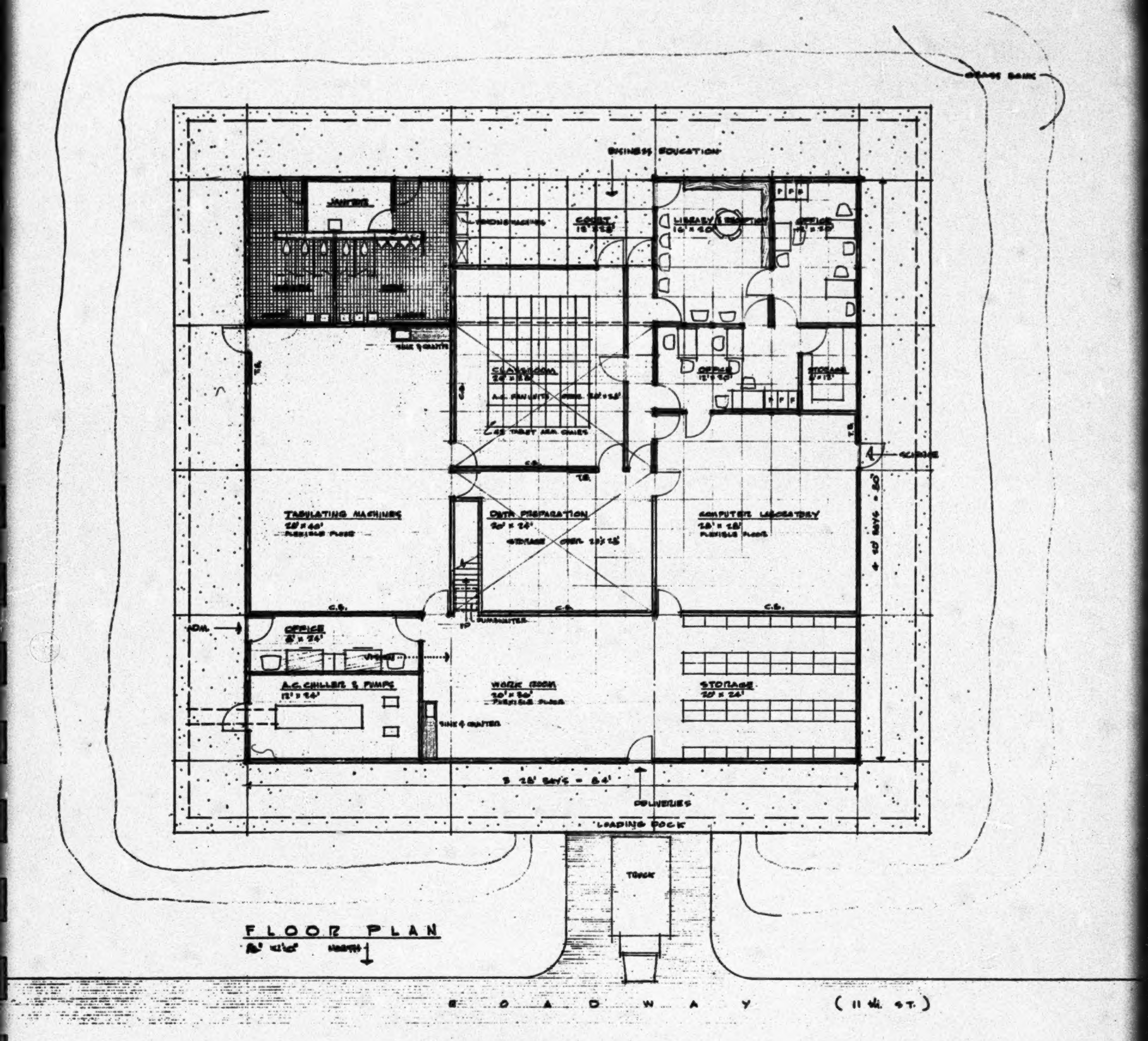
IBM 024 Card Punch (3)
IBM 026 Printing Card Punch (8)
IBM 056 Card Verifier
IBM 063 Card to Tape Punch
IBM 082 Card Sorter
IBM 085 Collator
IBM 402 Accounting Machine
IBM 514 Reproducing Punch
IBM 548 Interpreter
IBM Type 901 (063-514)Wiring Panels (31)
IBM Type 911 (548) Wiring Panels (16)
IBM Type 912 (085-602A) Wiring Panels (58)
IBM Type 917 (402) Wiring Panels (32)

Other Card Equipment:

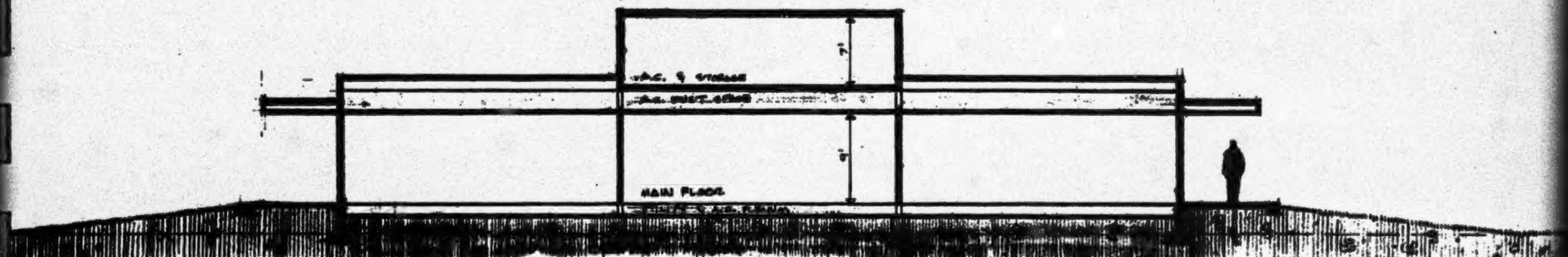
Royal McBee Keysort Edge Punch
Royal McBee General Records Poster (18)

Miscellaneous Equipment:

Autotutor Mark IV (2)
Friden Flexowriter (3)
MINIVAC 601
NCR Desk Calculator W/Tape Punch
NCR Bookkeeping Machine
Printing Calculators (2)
Rotary Calculators (4)


GRASS BANK
BUSINESS EDUCATION
JANITOR
DUPLICATING MACHINES
COURT 15' x 28'
LIBRARY & RECEPTION 16' x 40'
OFFICE
SINK & COUNTER
CLASSROOM 24' x 28'
A.C. FAN UNITS OPEN. 20' x 28'
45 TABLET ARM CHAIRS
OFFICE 12' x 20'
STORAGE
T.B.
SCIENCE
C.S.
TABULATING MACHINES 28' x 40' FLEXIBLE FLOOR
DATA PREPARATION 20' x 24'
STORAGE OPEN. 20' x 28'
COMPUTER LABORATORY 28' x 28' FLEXIBLE FLOOR
4 - 20' BAYS = 80'
ADM.
OFFICE 8' x 24'
DUMBWAITER
A.C. CHILLER & PUMPS 12' x 24'
WORK ROOM 20' x 30' FLEXIBLE FLOOR
SINK & COUNTER
STORAGE 20' x 24'
3 28' BAYS = 84'
DELIVERIES
LOADING DOCK
TRUCK
NORTH
R O A D W A Y (11th ST.)

FLOOR PLAN


A.C. & STORAGE
A.C. DUCT SPACE
7'
9'
MAIN FLOOR

CROSS SECTION

DATA PROCESSING CENTER

ORANGE COAST COLLEGE
osta mesa california

BLUROCK ELLERBROEK AND ASSOCIATES
ARCHITECTS
2515 E COAST HIWAY · CORONA DEL MAR OR [illegible]

Listed below are the textbooks in current use in the Orange Coast College program.

TEXTBOOKS

Introduction to Data Processing
    Elliot and Wasley, Business Information Processing Systems, Irwin, 1965 IBM, Operator's Guide

Computer Mathematics
    Theodore, Applied Mathematics an Introduction, Irwin, 1965

Data Processing Machines
    IBM Manuals: 402 and 103; 513 and 514: 085 and 087· 552 and 548
    IBM, Operators Guide

Programming Computers for Business (1st Semester)
    IBM, Fortran with Business Administration Examples
    IBM, 1401 Systems Reference Manual

Programming Computers for Business (2nd Semester)
    IBM, 1401 SPS and Autocoder Manuals

Computer Programming Systems
    Swindle and Fisher, Computer Programming Systems, Prentice-Hall, 1965.

Automated Data Processing Systems and Procedures
    Systems and Procedures Addociation, Business Systems, Vols.I and II, SPA, 1963

Computer Programming for Engineering, Mathematics and Science
    Germain, Programming the IBM 1620
    Prayor, Introduction to Basic Programming and Numerical Methods

On the following page is a diagram of the Orange Coast College Data Processing Laboratory. The facility has functioned well but is now becoming crowded and may soon have to be expanded.

The most significant hardware changes that have taken place since the inception of the program have been:

1. The 602 calculator was returned to IBM. It was felt by members of the department that the calculator was becoming rapidly obsolete and the principles developed by its teaching were accomplished effectively within the program on the computer and unit record equipment.
2. The LGP-30 computer used initially in the program to train students in computer programming has been given to the Technology Division to be used as a device for technician training. The LGP-30 was a fine teaching tool and was very valuable in teaching machine language programming, programming technique, and aided greatly in teaching single address drum memory concepts and number systems such as biniary, hexidecimal, octal, and systems other than base 10. However, as the computer grew older maintenance costs became prohibitive.
3. Two Royal McBee Tabulating Punches were also returned. Edge Punches and Royal McBee General Records Posters were retained for use. The Tabulating Punches were returned primarily due to the growth of the curriculum. It seems to be becoming so compact, and there is so much material to cover in the course sequence, it was felt that the tabulating punch concepts could better be covered in lecture.
4. The college is currently studying installation of one of the models of the IBM 360 series computers. However, due to the failure of a recent tax override election immediate decision regarding its installation has not been made.

CHAPTER V

CONCLUSIONS

The growth and success of the Orange Coast College Data Processing program has been validated by the success of its students and subsequent growth and demand for its offerings. The administration of the college feels that its decision to initiate the program in 1959 was a good one and the educational program is a step toward education fulfilling technologies mandate for educational support.

The training of army personnel has been very successful and the pilot high school program has served a useful lock step sequence in benefitting students.

It is unfortunate that the summer institute training program may no longer be offered. The contribution to education in terms of preparation to teach data processing in junior colleges throughout the country has been immeasurable. A side benefit which has been brought about from the institutes has been a sharing of information; what has turned out to be continual interaction between junior college data processing teachers within the state, and establishment of many programs based on a uniform and mutually developed need to fulfill an educational obligation in data processing.

Distinct curricular trends have developed away from extreme emphasis on unit record processing and a stress on computer systems and software has come about. With the advent the third generation computers and the growth in terms of numbers of companies using automated systems both the level of sophistication and demand for qualified trainees have increased.

The present program is only the harbinger of things to come. It will only be through continual evaluation that the program can effectively grow. In service training of staff, attendance at company schools to maintain immediacy with technological developments, continuous interdepartmental study, and cooperative efforts toward growth between members of the department are absolutely necessary if excellence in the program is to be maintained.

Use of student lab assistance has been a great help in developing departmental software and devices which are continually used in the program. And, a cooperative effort between the administration and staff is the mainstay ofthe program.

FOOTNOTES

1. "Massive Education Program Needed to Reduce Data Processing Failures," Educational Opportunities in the Information Sciences, January 1967, p.1

2. Ibid.

3. Ibid.

4. Ibid.

5. Bernard J. Luskin and Gilbert D. Saunders, Data Processing: A Practice Set, Teachers Edition, Greenwich, Connecticut: McBee Systems, a Division of Litton Industries, 1965, p.1

6. John Dufour, Business Data Processing, Department of Data Processing, Orange Coast College (Costa Mesa: By Orange Coast College) p.iv.

7. Ibid.

8. B. L. Geske and J.M. Geske, "Dealing with Individual Differences in Data Processing" Data Processor, March 1966, p.1

9. Dufour, op. cit., p. 1

10. Dana E. Gibson, "Business in the 80's," Data Processor, April, 1966, p.1

11. An Eight-Week Summer Institute Training Program to Retain Teachers for Teaching Business Electronic Data Processing, (Costa Mesa, Orange Coast College), p.1

12. G. A. Welles, Curricular Paths, (Los Angeles: IBM Corporation) p.16.

13. ibid., p.6

14. Dufour, op. cit., p.8

15. Norman E. Watson, "Education for Business Data Processing Technicians," 1963.

16. An Eight Week Summer Institute Training Program to Retrain Teachers for Teaching Business Electronic Data Processing, op cit., p.26

17. Ibid., p. 25

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3. Dufour, John, "Business Data Processing." A Study of the Initial Establishment of the Orange Coast College Data Processing Program, 1959."

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5. Gibson, Dana E., "Business in the 80's" Data Processor, Vol. 6, No. 6, (April 1966).

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7. Orange Coast College, Business Data Processing Curriculum, Mimeographed, 1966.

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9. Watson, Dr. Norman E., "Education for Business Data Processing Technicians," Orange Coast College, 1963. (Mimeographed)

APPENDIX A

DETAILED COURSE OUTLINES OF THE 1966-67 DATA PROCESSING CURRICULUM AT ORANGE COAST COLLEGE

ORANGE COAST COLLEGE
Business Data Processing
Curriculum

D.P. 1-Introduction to Data Processing (Fall; Spring) (3)

An introduction to basic methods, techniques, and systems of manual mechanical, and electronic data processing. Covers the history and development of data processing, manual and machine accounting equipment and systems, punched card, punched tape, and electronic data processing. Problems will be executed by the student on selected pieces of equipment. Three hours of lecture per week.

D.P. 51-Data Processing Machines (Fall; Spring) (3)

Basic operation and control of data processing machines other than electronic digital computers. The machines include IBM card punch, sorter, collator, reproducer, tabulator, and calculating punch. Some coverage is given to the operation of other data processing equipment with actual experience provided with the equipment in the O.C.C. Data Processing Center. Three hours lecture and two hours laboratory per week. Prerequisite: D.P. 1.

D,P, 61-Programming Computers for Business, Basic (Fall; Spring) (3)

A basic course in programming of electronic digital computers for those who plan to be programmers or those whose work may be closely related to computer applications in business and industry. Course covers characteristics of computers and computer programming or coding. Laboratory experience is provided on the Royal Precision general purpose electronic digital computer, the LGP-30. In addition, students write and execute programs in Fortran and in 1401 Machine Language. Three hours lecture and two hours laboratory per week. Prerequisite: D.P. 1.

D.P. 62-Programming Computer for Business, Advanced (Fall; Spring) (3)

Advanced course in electronic digital computer programming involving symbolic and macro programming, program timing and planning. 1401 SPS, 1401 Autocoder, and Disk Autocoder programs are written and executed. Three hours lecture, two hours laboratory per week. Prerequisite: Math 33 and D.P. 61 or Math 7.

D.P. 63-Computer Programming Systems (Spring) (3)

To provide a working familiarity with and appreciation of programming systems for medium and large scale digital computers. Emphasis on machine oriented systems--Autocoder, IOCS, Random & Sequential Storage; procedure oriented systems--FORTRAN IV, COBOL; problem oriented and support systems--RPG, Sort. The IBM 1401 and 1620 computers will be used. Three hours lecture, two hours laboratory per week. Prerequisite: D.P. 62 or equivalent.

D.P. 65-Pre-Science Engineering Data Processing (Summer) (6)

A course for recent high-school graduates who intend to attend a four-year college in preparation for a bachelor's degree and for Orange Coast College students who would take a survey course in data processing as part of a terminal or transfer program, 8 weeks, 5 days per week, 4 hours per day. Prerequisite: Two years of high-school algebra; high-school trigonometry.

D.P. 2-Automated Data Processing Systems and Procedures (Spring) (3)

A study of data processing systems and procedures including analysis of various existing data processing applications in business and industry. Includes a study of integrated or total management information and data processing systems. Emphasis is given to procedure writing and work simplification. Class projects include developing detailed procedures in various areas of a management information system. Three hours lecture and one hour laboratory per week. Prerequisite: D.P. 51, D.P. 61, and Acct. 2.

D.P. 3-Data Processing Projects (Spring) (2)

This course is designed to provide students with opportunities to gain experience in the development and implementation of scientific and/or commercial data processing problems. Making use of all the equipment available at the Data Processing Center, each student completes several individual projects in which he applies principles and techniques learned from previous data processing courses. Two hours lecture per week. Prerequisite: D.P. 62 and Acct. 2 or Math 7.

Math 33-Data Processing Mathematics (Fall; Spring) (3)

A prescribed course for the Business Data Processing Curriculum. Basic logic, the number system, algebra with emphasis on problem solving, computation with logarithms and with numbers in bases other than ten, Boolean Algebra. Three hours lecture per week. Prerequisite: Two years high school algebra, or Mathematics D.

Math 7-Computer Programming for Engineering, Mathematics and Science (Fall; Spring) (3)

Basic programming of electronic digital computers with emphasis on applications in engineering and mathematics. Machine language, symbolic and FORTRAN programming. Numerical techniques including integration, matrix inversion and Newtonian approximations. Laboratory experience provided on IBM 1620 Computer. Two hours lecture, three lab per week. Prerequisite: Grade "C" or better in Math 1A, 43, or 47B.

INTRODUCTION TO DATA PROCESSING

D.P. 1

HOURS REQUIRED

Class, 3

DESCRIPTION AND OBJECTIVES

An introduction to basic methods, techniques, and systems of manual, mechanical, and electronic data processing. Covers the history and development of data processing, manual and machine accounting equipment and systems, punched card data processing, punched tape data processing, and electronic data processing. Problems will be executed by the student on selected peices of equipment.

MAJOR DIVISIONS		Class Hours
I.	General Considerations and History	5
II.	Organization, Systems and Procedures	7
III.	Number Systems and Calculations	9
IV.	The Shape of Data - Their Care and Keeping	4
V.	Manual Data Processing	2
VI.	Electro-Mechanical Data Processing	6
VII.	Electronic Data Processing	8
VIII.	Computer Programming Systems	3
IX.	Notation and Coding Systems	3
X.	Applications	2
XI.	Industrial and Social Implications	2

DIVISION I. General Considerations and History

A. Definition of Data Processing

1. Operating Records
2. Accounting Records
3. Management Reports

B. The Elements of Data Processing

1. Classifying
2. Sorting
3. Calculating
4. Summarizing
5. Recording
6. Communicating

C. Overview of Business Activity. . . How Businessmen Earn Their Keep

1. Manufacturing
2. Extraction
3. Service
4. Financial Institutions
5. Distribution

D. A Word About Utility

1. Form
2. Place
3. Time
4. Possession

E. So What?

F. Historical Overview

1. Pre-history
2. Italy
3. William the Conqueror
4. Texts and Laws
5. Napier's Bones
6. Pascal's Machine Arithmetique
7. Thomas Arithometer
8. Parmalee Calculator
9. Felt "Macaroni" Box
10. Burroughs Early Adding Machine
11. Accounting Machines
12. Herman Hollerith
13. Punched Card Systems

G. Development of Electronic Data Processing

1. Babbage
2. Harvard Mark I
3. Tee ENIAC
4. Von Neumann
5. UNIVAC I
6. IBM 604 and Card-Programmed Calculator

H. Comment

DIVISION II - Organization, Systems and Procedures

A. Business as an Organization

1. Business is a Group of Individuals Trying to Satisfy a Certain Set of Goals
2. The Pursuit of Goals

B. Formal Organization

1. The Organization Chart
2. Line Relationships
3. Staff Relationships

C. Informal Organization: The Concept of Overlay

1. Social Overlay
2. Functional Overlay
3. Decision Overlay
4. Communications Overlay
5. Power Overlay

D. The Place of Data Processing in the Organization

E. The Nine Operations of Business: The Need for Information

1. Buying
2. Receiving
3. Stockkeeping
4. Production
5. Selling
6. Delivery
7. Billing
8. Collecting
9. Disbursing

F. Business Forms: The Carriers of Information

G. Information Flow: Forms Flow Charting

H. The Notion of a System

1. Objectives
2. Decisions
3. Policies
4. Procedures
5. Systems

I. The Need for Systems Study

1. Changing Organization Structure
2. Diversification
3. International Operations
4. Prevailing Attitudes

J. The Tasks of an Information System

1. Processing Data
2. Continuous Self-Redesign

K. The Failure of Conventional Accounting Systems

1. Confusion
2. Failure to Highlight Important Aspects of Business

L. Basic Information Needs of Modern Large Companies

1. Environmental Information
2. Competitive Information
3. Internal Information
4. Success Factors

M. Systems Analysis: Flow Charts

1. Procedural Flow Chart
2. General Flow Chart
3. Block Diagram

N. PERT

DIVISION III - Number Systems and Calculations

- A. Number Systems in General
  1. Integers
  2. Non-Integers
- B. A Number of Number Systems
  1. Binary, Tertiary, Quinary, Octal, Decimal, Hexadecimal, et al.
- C. Conversion Technique
  1. Decimal to Non-Decimal
  2. Non-Decimal to Decimal
- D. Multiplication and Division
- E. Complement Addition, Or, I'm Just As Smart As Any Computer

DIVISION IV - The Shape of Data - Their Care and Keeping

- A. Binary Mode Data Representation
  1. Binary Coded Decimal (BCD)
  2. Seven-Bit Alphameric Code
  3. Other Coding Systems
- B. Data Recording/Storing Devices (Secondary Memory)
  1. Traditional Devices
  2. Punched Cards
  3. Sequential Devices
  4. Random Access Devices
- C. Memory Devices (Primary Memory)
  1. Drum Storage
  2. Core Storage
  3. Mercury Pool and Acoustical Delay Lines
  4. Cathod Scanners
- D. Data Communications
  1. Input/Output Devices
  2. Data Transmission
  3. Buffering: The Problem of Speed

DIVISION V - Manual Data Processing: The McBee Keysort System

DIVISION VI - Electro-Mechanical Data Processing

- A. The Unit Record
  1. The IBM Card
  2. Card Fields
  3. Advantages of Unit Records
  4. Disadvantages of Unit Records

B. Elements of Machines

   1. Card Feeding
   2. Card Reading
   3. The Control Panel
   4. Printing Units

C. The Card Punch and Verifier

   1. Operating Features of the IBM Card Punch
   2. The Keyboard
   3. The Program Unit
   4. Card Punching Without Program Control
   5. Card Punching With Program Control
   6. Verification of Punching

D. The Sorter

   1. General Sorting Concepts
   2. Operation Features of IBM 082 Sorter
   3. Operating Procedure
   4. Machine Functions
   5. Block Sorting

E. The Interpreter

   1. Machine Operations of IBM 548 Interpreter
   2. Machine Control

F. The Reproducing Punch

   1. Features of IBM 514 Reproducing Punch
   2. Functions

G. The Collator

   1. Features of the IBM 085 Collator
   2. Functions
   3. Machine Schematic

H. Accounting Machine

   1. Function of the IBM 402 Accounting Machine
   2. Features

DIVISION VII - Electronic Data Processing

A. Computers in General

   1. The Elements of Computers
   2. Analog vs. Digital Computers
   3. General vs. Special Purpose Computers
   4. On-line vs. Off-line
   5. Small vs. Large Computers
   6. Evolution of Computers

- B. The CRAZIAC, World's Slowest Computer
- C. Digital Computer Operation

DIVISION VIII - Computer Programming Systems

- A. Machine Language vs. The King's English
    1. The Problem
    2. The Purpose
    3. Parts of a Programming System
- B. Types of Programming Systems
    1. Machine-Oriented
    2. Procedure-Oriented
    3. Problem-Oriented
    4. Support Systems
- C. Machine-Oriented Programming Systems
    1. Assembly Systems
    2. Macro Systems
    3. Input/Output Control Systems
- D. Procedure-Oriented Systems (Compilers)
    1. FORTRAN
    2. ALGOL
    3. COBOL
- E. Problem-Oriented Systems
    1. Report Generators
    2. Tabular Languages
- F. Support Systems
    1. Utility Systems
    2. Sort Systems
    3. Simulators
    4. Monitors
- G. Advantages of Programming Systems
    1. Faster Programming
    2. Program Efficiency
    3. Faster Error Detection and Correction
    4. Improved Documentation
    5. Reduced Training Requirements
    6. Machine Independence of Programs and Programmers

DIVISION IX - Notation and Coding Systems

- A. Scientific Notation
- B. Modular Arithmetic

C. Coding Systems: General

   1. Encoding vs. Converting
   2. Weighted vs. Unweighted

D. Coding Systems: Specific

   1. 2* 4 2 1
   2. 5 4 2 1
   3. Excess Three
   4. Bi-Quinary
   5. Two Out of Five
   6. Three Out of Five
   7. Error Checking Codes
   8. Reflected Codes (Number Systems)
   9. Self-Correcting Code (Hamming)
   10. Code Choice Factors

DIVISION X - Applications

A. Accounts Payable

   1. Vouchers
   2. Voucher Register
   3. Paid Vouchers
   4. Unpaid Vouchers
   5. Distribution

B. Payroll Procedures

   1. Salary Payroll
   2. Hourly Rate Payroll

C. Linear Programming

D. Simulation: Management Games

   1. The Education of Businessmen
   2. Game Procudrre

E. Numerical Control

   1. A Word About Automation
   2. Typical Computer Approach

DIVISION XI - Industrial and Social Implications

AUTOMATED DATA PROCESSING SYSTEMS AND PROCEDURES

B.E. 2

HOURS REQUIRED

Class, 3; Laboratory, 1

DESCRIPTION

A study of data processing systems and procedures including analysis of various existing data processing applications in business and industry. Includes a study of integrated or total management information and data processing systems. Emphasis is given to developing detailed procedures in various areas of a management information system. Prerequisite: B.E. 14A, B.E. 17A, B.E. 42.

MAJOR DIVISION		Class Hours	Lab Hours
I.	Introduction to Systems-Procedures	6	1
II.	The Systems Survey	12	4
III.	System Analysis, Design & Installation	6	2
IV.	Systems and Procedures Programs	3	
V.	Accounting Systems and Procedures	12	5
VI.	Automated Data Processing Systems Analysis and Design	9	9

DIVISION I - Introduction to Systems and Procedures - Accounting and Data Processing

A. Units of Instruction - 6 Hours
  1. Management and the systems functions
    a. The functions of management
      (1) Planning
      (2) Organizing
      (3) Staffing
      (4) Directing (executing or doing)
      (5) Controlling
    b. Organizational complexity
      (1) Span of control
      (2) Delegation of authority
      (3) Line of communication

- c. Concept of line and staff
  - (1) Nature of line and staff relationship
  - (2) Function and authority of each
  - (3) Line and Staff friction
- d. Organizational planning
  - (1) Basis of departmentalization
  - (2) Basis of assignment of activities
  - (3) Basic organization principles
- e. Systems and management
  - (1) Line responsibility for systems and procedures
  - (2) Systems and procedures as a staff function
  - (3) What can management expect from systems and procedures?
  - (4) The role of written procedures
- f. The evolution of the systems and procedures function in management
  - (1) Scientific Management
  - (2) Systems as an outgrowth of accounting
  - (3) Evolution of office management
  - (4) Influence of new data processing techniques

2. Systems Concepts
   - a. Definitions
     - (1) Objectives
     - (2) Policy
     - (3) System
     - (4) Procedure
     - (5) Method
   - b. Systems specialization
     - (1) Areas of systems - organization, work measurement, forms control
     - (2) Types of systems - accounting systems, production control system, computer programming and applications
   - c. Major responsibilities of the systems and procedures function
     - (1) Organization planning and analysis
     - (2) Systems analysis
     - (3) Procedures and bulletins
     - (4) Form design and control
     - (5) Report analysis and control
     - (6) Records management
     - (7) Work measurement
     - (8) Office equipment and selection
     - (9) Office Layout
   - d. New trends and their effect on systems and procedures
     - (1) Revolution in data handling
     - (2) Operations research
     - (3) Trend towards total systems approach
     - (4) Participation in management development
     - (5) Administrative management concept

e. Establishing the systems program
  (1) Obstacles to effective systems programs
  (2) Basis for effective systems programs
  (3) Principles for a sound systems and procedures approach
  (4) Place of systems and procedures in the organization

3. The processing of data
  a. The nature of data
    (1) The transaction
    (2) Basic types of data
    (3) Relationship of data to various lines of management
    (4) Internal and external needs for data
  b. The data medium
    (1) Record of a transaction
    (2) Basic types of transaction records
    (3) Need for complete transaction information on the business papers in relationship to future data needs
  c. Data flow
    (1) Document flow
    (2) Processing operations
    (3) Files and records
    (4) Reports
    (5) Document control

4. The structure and classification of data and accounts
  a. The chart of accounts
    (1) Definition
    (2) Organizational relationship
  b. Designing a chart of accounts
    (1) Source information
    (2) Output statements, reports or documents
    (3) Size of business
    (4) Character of its operation
    (5) Organizational structure
    (6) Geographic dispersion
  c. Account classification
    (1) Basic account classification
    (2) Account numbering systems

5. Organization for data processing, accounting, and systems and procedures
  a. Functional and personnel organization
    (1) Top management
    (2) Controllers division
    (3) Systems and procedures
    (4) Data processing
  b. Organization functions
    (1) Accounting service to management
    (2) Internal control
    (3) Principles of internal control - organization, physical protection of assets, recording, control of assets, personnel, and internal auditing

6. Management reports
    a. Principles of a report system
        (1) Report - brief and to the point
        (2) Report - promptly and for the right period
        (3) Report - relate to overall systems
    b. Reporting areas and levels
        (1) Income and expense
        (2) Division, products, territories, etc.
        (3) Management level (responsibility accounting or reporting) - foreman, supervisor, plant manager, division manager, top management
    c. Report elements
        (1) Concise
        (2) Comparative (horizontal - vertical)
        (3) Summary
        (4) Charts or graphs in reports

DIVISION II - The Systems Survey

A. Units of Instruction - 12 hours

- 1. Objectives, phases and types of systems surveys
  - a. Objectives of a systems study
    - (1) To reduce operating and clerical costs
    - (2) To increase clerical productivity
    - (3) To provide more complete data and information for management
    - (4) To increase accuracy and speed in the preparation of management reports
    - (5) To eliminate unnecessary functions and activities
    - (6) To eliminate unnecessary controls and thus strengthen the organizational structure
    - (7) To improve service to customers
    - (8) To reduce inventory and other working capital requirements
  - b. Phases of a systems survey
    - (1) Survey present procedures and controls system
    - (2) Analysis of data or facts gathered in the survey
    - (3) Development of systems and procedures improvements
    - (4) Presentation of recommendations to management
    - (5) Installation of improved or newly designed system
  - c. Types of systems surveys for either the entire system or a phase of the system
    - (1) Procedures
    - (2) Processes
    - (3) Operations
    - (4) Equipment
    - (5) Organization of accounts and files
    - (6) Internal controls
    - (7) Forms
    - (8) Methods
    - (9) Personnel
- 2. Survey initiation - problem definition
  - a. Awareness of the problem
    - (1) Visibility of sypmtoms - apparent or hidden
    - (2) Nature of sypmtoms - results: incomplete, inaccurate, inconsistent or non-existent
    - (3) Sources of recognition of the problem
  - b. Decision to act on a recognized problem
    - (1) Obstacles to decision
    - (2) Area of decision
    - (3) Assignment of responsibility

c. Determining the scope of the problem
  (1) Relationship to symptoms
  (2) Presurvey to determine problem scope
  (3) Survey - brief, yet thorough
  (4) Evaluation of presurvey
d. Planning the project
  (1) Survey scope
  (2) Factors to be considered
  (3) Interim solution
  (4) Complete solution
  (5) Analytical considerations
  (6) Assignment of responsibility
e. Clearing the project - presentation to management
  (1) Statement of the problem
  (2) Proposed plan of attack
  (3) Charts and tables
  (4) Indicated directions of solutions
  (5) Areas to be included in the survey
  (6) Authority needed

3. Fact gathering
a. Methods of fact gathering
  (1) Interviews (who and how)
  (2) Questionnaires
  (3) Review of existing procedures, job descriptions, etc.
  (4) Data collected by operating personnel
  (5) Work sampling (detailed in next unit)
b. Scope of survey effects choice of fact gathering method
  (1) Interdepartmental or intradepartmental
  (2) Time limits
  (3) Manpower
  (4) Authority
  (5) Existing data
  (6) End product
c. Type of survey effects choice of method of fact gathering
  (1) General survey
  (2) Work measurement
  (3) Forms control/records management
  (4) Organization study
  (5) Feasibility study
  (6) Other specific problems

4. Work sampling
a. Definition
  (1) The process of taking samples of a work activity and, by following definite rules making reasonable judgements about the entire works picture

        - (2) Sampling is a faster, less costly way of gathering data concerning a business activity
    - b. Uses and application of work sampling
        - (1) Quality control
        - (2) Work verification
        - (3) Data gathering
        - (4) Auditing
        - (5) Costing production
        - (6) Billing by average
        - (7) "Ratio delay" determining use of employee's time
        - (8) Obtaining data for management not normally produced by the system
    - c. Sampling based on statistical methods
        - (1) The normal curve of error
        - (2) Probability and sample size
        - (3) Probability tables
        - (4) Sampling tables
    - d. Factors affecting sampling
        - (1) Ranges of values
        - (2) Sample size
        - (3) Lot size
        - (4) Defining the problem
        - (5) Observation recording time
        - (6) Frequency of observation-set random and duration or time allotted to each observation
- 5. Charting - types and techniques
    - a. Use of charts in systems work
        - (1) Survey
        - (2) Design
        - (3) Presentation
        - (4) Installation
    - b. Methods of charting
        - (1) Planning (type and quantity of information needed)
        - (2) When to chart
        - (3) Charting cost versus value
        - (4) Chart identification
    - c. Charting tools
        - (1) Tools
        - (2) Materials
        - (3) Reproduction
    - d. Basic uses of charting
        - (1) Operational chart - depict the progression of operations
        - (2) Architectural chart - present an outline picture of physical areas (often combines with work flow or work area analysis)

(3) Personnel relationship chart - indicate lines of authority, responsibility, and function
(4) Statistical chart - summarizes numeric and chronological relationships
(5) Other special purpose charts
e. Types of systems charts
(1) Flow charts
(2) Organization charts
(3) Miscellaneous charts
6. Flow charting
a. Flow charts
(1) Operational flow charts (flow process charts)
(2) Schematic flow charts (pictorial charts)
(3) Forms flow charts
(4) Layout flow charts (form routing charts)
(5) Punched card and compiter procedure flow charts (logical or block diagrams)
(6) Forms distribution charts (forms routine diagram)
b. Basic requirement of flow charting
(1) Contain only necessary detail
(2) Easy to read
(3) Layout should be neat
(4) Permit easy reproduction
c. Various standards and symbols of flow charting
(1) Therbligs (designed by Dr. Frank Galbreth)
(2) ASME (American Society of Mechanical Engineers) Standard-symbols
(3) NOMA (National Office Management Association) Standards and symbols
(4) IBM (International Business Machines) Remington Rand UNIVAC, Burroughs Electrodata, etc.
(5) Moore Business Forms, Standard Register Company, UARCO, etc. for analysis by their representatives
d. Definitions of the basic symbols used in flow charting.
e. Flow chart symbols by type and application
f. Charting techniques - use of symbols to represent special situations
7. Organization charting (personnel relationship)
a. The organization chart defined
(1) Top box - full responsibility (president)
(2) Reserved and delegated responsibility
(3) Reserved and supervisor Over delegated responsibility
(4) Reserved and authority Over accountability or obligation

- b. How the organization chart works
    - (1) Defining line relationship
    - (2) Depicting situations requiring coordination as well as control
    - (3) Delegation of responsibility
    - (4) The staff versus line relationship
- c. The mechanics of preparing an organization chart
    - (1) Solid lines
    - (2) Dotted Lines
    - (3) Types of boxes
    - (4) Function charts

8. Miscellaneous charts
    - a. Other special purpose charts
        - (1) Work distribution charts
        - (2) The linear responsibility chart
        - (3) Gantt or scheduling chart
    - b. Statistical or graphic charts
        - (1) Definition and purposes
        - (2) Bar charts
        - (3) Vertical and horizontal scales
        - (4) Pictorial charts
        - (5) The time series line chart
        - (6) Curves and plotting
        - (7) Strata charts
        - (8) Ratio charts
        - (9) Probability charts
        - (10) Progress charts

DIVISION III - Systems Analysis, Design and Installation

- A. Units of Instructions - 6 Hours
  - 1. Systems analysis
    - a. Definition and requirements
      - (1) Definition - the examination of something to distinguish its component parts or elements, separately or in the relationship to the whole
      - (2) Analysis requires comprehensive and thorough evaluation of the present situation as documented in the fact-finding phase of the survey
    - b. Key areas
      - (1) Management philosophy and policy regarding the system
      - (2) The organization used to carry out the system
      - (3) The procedures and methods employed
      - (4) Personnel staffing and utilization
      - (5) Equipment and its utilization
      - (6) Facilities
      - (7) Costs
  - 2. Data and facts
    - a. Review the facts on personnel
      - (1) Employee's work habits
      - (2) Ages, education - skills of present personnel
      - (3) Quality of supervision and organizations levels
    - b. Review the processing cycle
      - (1) What steps require the most man or machine hours
      - (2) Where and what are the bottlenecks in the system
      - (3) Are there natural breaking points in the system
    - c. How is system related to the whole?
      - (1) What are the outside sources of input?
      - (2) What are the outside receptions of output?
      - (3) Do all present operations belong in the system?
      - (4) Is all input and output compatable to needs?
    - d. Workloads and requirements
      - (1) How many units, documents or entries are processed
      - (2) What reports are required from the system
      - (3) What are scheduled closing dates or cut off times
    - e. Procedures
      - (1) How many procedures in the system and how many operations in each procedure
      - (2) Can some operations be eliminated or combined or procedures be combined
      - (3) Total man hours required by the system
      - (4) How many hours are required to process one transaction, unit or document

- f. Physical layout and equipment
  - (1) Does present layout require unnecessary steps
  - (2) Does location provide for straight line flow
  - (3) What type of mechanical equipment is utilized
- g. Evaluate the paperwork
  - (1) How many forms involved in the system
  - (2) Can some form be eliminated or combined
  - (3) Do present forms provide sequential arrangemen of data
  - (4) Can some operations be eliminated or reduced b form redesign
  - (5) Can cost of forms be reduced
- h. Analyze controlling factors
  - (1) What company policies govern the system
  - (2) Will policy revision eliminate "exception conditions"
  - (3) Does company policy permit combining or doing the work elsewhere

3. Questions to be asked of each operation and systems detail
   - a. What?
   - b. Where?
   - c. When?
   - d. Who?
   - e. How?
   - f. Why?
4. Systems design
   - a. Definition
     - (1) The creative stage in devising a new or revised system - dreaming, inventing, planning etc. to achieve the objectives of business
     - (2) Design considers processing methods, facilitie and the data needed for both management and operating information
   - b. Levels of design
     - (1) Copy and modify a similar system used in another business
     - (2) Devise a new system utilizing existing equipment
     - (3) Invent an entirely new system that may requir designing new equipment or modifications of existing equipment
   - c. Design requirements
     - (1) Matching managements' requirements with available equipment and capabilities of personnel
     - (2) Clearly stated short and long range systems objectives
   - d. Develop systems specifications
     - (1) Information output-content, format
     - (2) Organization - who
     - (3) Equipment and costs - nature of, installation and flexability
     - (4) Safety factors - input quality, error detectio and tracing operations

5. Installations and follow up
  a. Installation
    (1) Planning - all at once, piecemeal type
    (2) Scheduling
      (a) Lead time
      (b) Sequence of work
    (3) Organization
    (4) Personnel
    (5) Programming
    (6) Physical installation - equipment and facilities
  b. Follow up
    (1) What to check for
    (2) When to follow up
    (3) Who should follow up
    (4) How to perform follow up
    (5) Why follow up

DIVISION IV - Systems and Procedures Programs

- A. Units of Instruction - 3 Hours
  - 1. Company manuals
    - a. Need for manuals
      - (1) The manual as a tool of communication
      - (2) Evolution of a typical manual
      - (3) Advantages of good manuals (if used)
      - (4) Resistance to manuals
    - b. Types of manuals
      - (1) Policy manual
      - (2) Organization manual
      - (3) Procedure manual
      - (4) Job instruction manual
    - c. Organizing the materials for manuals
      - (1) Objectives of good organization
      - (2) Ways to organize contents of the manual
      - (3) Organizing a single policy within a manual
      - (4) Numbering systems
      - (5) Illustrations
    - d. Design of the manual
      - (1) Page format
      - (2) Arrangement of contents
    - e. Assuring use of the manual
      - (1) Make sure manuals are kept current
      - (2) Insist that interoffice correspondence make reference to the manuals as a source. This will avoid wasteful quoting or paraphrasing of manual material
      - (3) Revise all manuals at least once a year
  - 2. Forms design and control
    - a. What forms means to the office - organization
      - (1) Requirements of good forms design
      - (2) Ease of entry data
      - (3) Use of data after entry
      - (4) Savings in paper and printing costs
    - b. Forms systems
      - (1) Form numbering systems
      - (2) Form classification systems
    - c. Elements of a form
      - (1) Paper or card stock
      - (2) Words or characters
      - (3) Lines and rules
      - (4) Spaces
      - (5) Heading
      - (6) Body
      - (7) Multipart form

- d. Tools of forms design
  - (1) Graph paper
  - (2) Drawing pencil, sandpaper Block
  - (3) Rulers and straight edge
  - (4) Scissors and knife
  - (5) Eraser - wiping cloth
  - (6) Rubber cement
- e. Designing the form
  - (1) Purpose, content and place within the system must be thoroughly understood by the designer
  - (2) Selection of size
  - (3) Placement of titles and form numbers
  - (4) Filing data on form
  - (5) Designing the introduction or heading and body of the form
  - (6) Window envelope segments in design
- f. Writing the specifications
  - (1) Identification of the form
  - (2) Size
  - (3) Paper
  - (4) Margins
  - (5) Printing instructions
  - (6) Grain of paper
  - (7) Registration
  - (8) Perforating
  - (9) Collating
  - (10) Punching, etc.
- g. Forms control
  - (1) Past
  - (2) Present - impact of IDP and EDP
  - (3) Future
  - (4) Form control responsibilities
  - (5) Form control procedures

3. Work measurement
   - a. Work measurement concepts
     - (1) Definitions
     - (2) Philosophy - basic
     - (3) Purpose and objectives
     - (4) Comparison with other management tools
   - b. Objectives of a work measurement program
     - (1) Planning - scheduling work more effectively
     - (2) Improved forecasting of manpower requirements
     - (3) Determine most economic work methods
     - (4) Determine proper work assignments
     - (5) Determine time and cost of work to be performed
     - (6) Others
   - c. Work count
     - (1) Purpose
     - (2) Selecting the work count unit

(3) Use of existing counts
(4) Supplementary counts
(5) Uses of work count
(6) Valuing the work count
(7) Actual time per unit, a basis of measurement
d. Work standards
(1) Primary purpose
(2) Definition
(3) Concept of a "fair day's work"
e. Methods analysis and work measurement
(1) Best way then measure
(2) Evaluation of alternative methods
(3) Standard practice instructions and procedures
f. Approaches to work standard development
(1) Subjective approach - rule of thumb standard
(2) Statistical approach - analysis of past time and production records statistically to determine standard
(3) Engineering approach
g. Standards in evaluating performance
(1) Percentage of effectiveness
(2) Variance between standard and actual
h. Application of work standards
4. Operations Research
a. Introduction
(1) Basic concepts
(2) Military origns in World War II
(3) The scientific management movement
b. Characteristics of operating research
(1) The scientific method
(2) Mathematical models
(3) Solutions from models
c. Techniques of operations research
(1) Probability theory and statistical theory
(2) Linear Programming
(3) Queuing or waiting - line theory
(4) Game theory
(5) Simulation and strategic gaming techniques
(6) Monte Carlo techniques
(7) Search theory
(8) Value theory or theory of decision
(9) Information theory, flow technique and communications models
(10) Symbolic logic
(11) Matrix analysis
(12) The role of electronic computers

d. The role of operations research in business
    (1) Problem of communications between business man and operations researcher
    (2) The relationship of operations researcher to the executive
    (3) The relationship of operations researcher to other business staff functions
    (4) Feasibility study

DIVISION V - Accounting Systems and Procedures

A. Units of Instruction - 12 Hours
  1. Sales orders, billing, accounts receivable, etc.
    a. Sales procedure defined
    b. Order procedure - document flow
    c. Billing procedure - document flow
    d. Accounts affected by order and billing
    e. Order and billing - Internal control
    f. Methods and devices for order and billing
    g. System survey - order and billing procedures
    h. Sales department
    i. Interviews and conferences
    j. Order procedure
    k. Shipping procedure
    l. Billing procedure
  2. Cash receipts
    a. Kinds of cash receipts
    b. Cash receipts - document flow
    c. Internal control of cash receipts
    d. System survey - cash receipts
  3. Accounts receivable, statements and distribution
    a. Accounts receivable and statements defined
    b. Accounts receivable handling methods
    c. Accounts receivable posting methods
    d. Statement preparation
    e. Sales distribution methods
  4. Purchasing order, receiving report, accounts payable, etc.
    a. The purchase system
      (1) Definition of purchase system
      (2) The goods and service involved
      (3) The procedures involved
      (4) Initiating the purchase
      (5) Consummating the purchase
      (6) Receiving goods
      (7) Processing purchase invoices
      (8) Accounts payable
    b. Distribution, disbursements
      (1) Distribution of charges for purchases
      (2) Cash disbursements
      (3) Accounting organization and responsibilities with purchasing systems and procedures
      (4) Accounting documents in the system
      (5) Systems survey - purchase and cash disbursement system
  5. The timekeeping and payroll system
    a. Introduction
      (1) Payroll accounting objectives
      (2) Organization for payroll control
      (3) Division of duties and responsibilities

b. Timekeeping system
  (1) Attendance or shop timekeeping
  (2) Weekly attendance cards and shop time cards
  (3) Control procedures
c. Payroll system
  (1) Payroll preparation
  (2) Paying the employee
  (3) Labor distribution
  (4) Payroll records
  (5) Payroll processing methods

6. Manufacturing cost systems, production control, etc.
  a. Production control procedures
    (1) Production control defined
    (2) Production control organization
    (3) Production control in specific order industries (job order)
    (4) Machine loading
    (5) Production control in repetitive order situations
    (6) Systems survey - analysis production control
  b. Manufacturing - cost systems
    (1) Kinds of costs systems
    (2) Materials records and procedures
    (3) Materials and inventory control
    (4) Materials costing methods
    (5) Direct-indirect labor costs
    (6) Overhead costs
    (7) Analysis and control of overhead
    (8) Systems survey - manufacturing cost systems

7. Advanced systems approach to systems and procedures
  a. Available techniques
    (1) Degree of automation - manual to full automatic
    (2) Capacity of equipment
    (3) Specialization versus full on line processing
    (4) Filing methods
  b. Fragmentary versus consolidated processing
    (1) Fragmentary processing
    (2) Consolidated processing
    (3) Actual practice today
  c. Input methods
    (1) Ratio of equipment to labor
    (2) Accuracy of input by input method
    (3) Input loading
  d. Data flow
    (1) On-line processing
    (2) In-line processing
    (3) Off-line processing

- e. Sorting
  - (1) Block sorting
  - (2) Digital sorting
  - (3) Sorting methods
- f. File maintenance and processing
  - (1) File maintenance or modification
  - (2) File processing or posting
- g. Integrated data processing
  - (1) Departmental data handlings
  - (2) Mechanized duplication
  - (3) Functional integration
  - (4) Common languages and functional integration

DIVISION VI - Automated Data Processing Systems Design and Applications

A. Units of Instruction - 9 Hours

1. Case History study and projects covering the systems design work necessary in order to properly utilize EAM or computing equipment

TEXT

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Hattery, Lowell H., and George P. Bush. Electronics In Management. Washington, D.C.: The University Press of Washington, D.C., 1956.

Herrmann, Irvin A. Office Methods, Systems, and Procedures. New York: The Ronald Press Company, 1950.

Knox, Frank M. Design and Control of Business Forms. New York: McGraw-Hill Book Company, Inc., 1952.

Nelson, Oscar S., and Richard S. Woods. Accounting Systems and Data Processing. Cincinnati, Ohio: South-Western Publishing Company, 1961.

Neuner, John J.W. Office Management Principles and Practices, Fourth Edition. Cincinnati, Ohio: South-Western Publishing Company, 1959.

Neuschel, Richard F. Management by System. Second Edition. New York: McGraw-Hill Book Company, Inc., 1960.

Newman, William H., and James P. Logan. Business Policies and Management, Fourth Edition. Cincinnati, Ohio: South-Western Publishing Company, 1959.

Reinfield, Nyles V. Production Control. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1959.

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DATA PROCESSING PROJECTS

D.P. 3

HOURS REQUIRED

Class, 2 per week

DESCRIPTION AND OBJECTIVES

This course is designed to provide students with opportunities to gain experience in the development and implimentation of scientific and/or commercial data processing problems. Making use of all the equipment available at the Data Processing Center, each student completes several individual projects in which he applies principles and techniques learned from previous data processing courses. Prerequisite: D.P. 62 and Acct. 2 or Math 7.

MAJOR DIVISIONS	Class Hours
I. Problem Definition and Orientation	2
II. Problem Environment	3
III. Systems Review	6
IV. System Development	14
V. Implementation of Proposed System	5
VI. Analysis and Critique	4

DIVISION I - Problem Definition and Orientation

A. Students are assigned several individual projects in this course. The projects will be oriented but not limited to the following areas of business activity:

1. Order writing, billing, sales analysis
2. Cash collections
3. Purchases and cash disbursements
4. Inventory control
5. Payroll and timekeeping
6. Production control
7. Manufacturing costs
8. Personnel accounting
9. Numerical analysis
10. Linear programming
11. Data analysis
12. Simulation techniques

B. Students are to design appropriate systems to perform the data processing activities (outlined in Section A) required in their projects. Students are also required to implement their proposed systems with equipment existing in the data processing center, where applicable.

C. An interchange of ideas is considered desirable between business and scientific oriented students. This should stimulate some understanding and need for cooperation between these two vital lenks in the data processing process.

DIVISION II - Problem Environment

A. Organizational structures for business control

   1. Basic accounting functions
   2. Organizational structures
   3. Internal control principles

B. The structure and classification of accounts

   1. Designing a chart of accounts
   2. Basic account classifications
   3. Numbering the accounts

C. Methods and devices

   1. Manual
   2. Mechanical
   3. Electro-mechanical
   4. Electronic
   5. Combinations of methods and devices

DIVISION III - Systems Review

A. Systems terminology

   1. System
   2. Procedures
   3. Process
   4. Operation

B. Nature of systems review

C. Objectives of systems review

D. Systems review - equipment investigation

E. Systems review - resolving equipment investigations

F. Systems review - modification of coding systems

G. Systems review - internal controls

H. Working papers for fact gathering

DIVISION IV - System development

A. Systems analysis

1. Constant and variable data
2. Volume considerations
3. Reporting requirements
4. Scheduling of output data

B. Preparation of proposals

1. Tools

    a. Flow charts

        (1) Purpose
        (2) Types - general and procedural
        (3) Symbols

2. Design of source documents and input data

3. Job descriptions

4. Documentation and control

5. Data protection

C. Cost comparisons of alternate systems

D. Presentation of proposals

DIVISION V - Implementation of Proposed System

A. Operators Manual

1. Contents

    a. Samples of source documents
    b. Flow charts
    c. Card layout forms
    d. Job description sheets
    e. Report layout forms
    f. Program documentation
    g. Error detection and restart procedures

NOTE: Students are required to demonstrate their proposed systems from the operators manual.

DIVISION VI - Analysis and Critique

A. Review of proposed systems

1. Review of systems analysis
2. Discussion of alternate approaches
3. Revision and finalization
4. Documentation

NOTE: Selected students present their proposed systems to the class.

TEXT:

ACCOUNTING SYSTEMS and DATA PROCESSING - Nelson, Woods

DATA PROCESSING MACHINES

D.P. 51

HOURS REQUIRED

Class, 3; Laboratory, 2

DESCRIPTION AND OBJECTIVES

Basic operation and control of data processing machines other than electronic digital computers. The machines include IBM card punch, sorter, collator, reproducer, tabulator, and calculating punch. Some coverage is given to the operation of other data processing equipment with actual experience provided with the equipment in the OCC Data Processing Center. Prerequisite: D.P. 1 and Acct. 1.

MAJOR DIVISIONS		Class Hours	Laboratory Hours
I.	Introduction to Punched Card Machine Programming	10	2
II.	Programming the Interpreter	3	2
III.	Programming the Reproducer	7	6
IV.	Programming the Collator	6	4
V.	Programming the Accounting Machine-1	9	6
VI.	Programming the Accounting Machine-2	10	10
VII.	Programming the Calculator	9	6

DIVISION I - Introduction to Punched Card Machine Programming

A. Units of Instruction - 10 Hours
  1. Principles of electromechanical machines
    a. The control functions of the punched card
    b. Card reading and reading units
    c. Card movement in the machines
    d. The control panel and setup of machine circuits through wiring of the control panel
    e. Types of control panels, wires, plugs, connectors, etc. and their use
    f. Machine timing and timing charts
  2. Introduction to the electromechanical units and their functions in punched card machines
    a. Printing units - typebars, typewheels
    b. Punching units - punch, die, punch magnet
    c. Electrical magnets and relays - their construction, types of relays, various functions and related machine terminology

- d. Comparing units - their functions, types of relays used, operating principles and applications
- e. Column splits, machine times selectors or relays, their functions and application
- f. Selectors - their purpose, construction, types of relays used, their functions and applications
- g. Arithmetic units-counters - their functions, operating principles, methods of control and applications
- h. Storage units - types of, construction, functions, methods of control and applications
- i. Programming units - types of, functions, construction, methods of control and control functions, and applications

3. Control panel diagrams, planning charts, and program planning
    - a. Purpose of planning charts and diagrams
    - b. Recording the problem - card layout, card or report format, and functions to be accomplished
    - c. Analyzing the problem - input, functions to be performed and output
    - d. Planning the solution - orientation of problem and machine, layout of problem on machine planning charts
    - e. Diagramming the control panel - techniques of diagramming, use of colored pencils, etc.

B. Laboratory Projects - 2 Hours

1. Displays and demonstrations
    - a. Display when available actual samples of the internal units of the machine such as typebars, typewheels, various types of relays, etc.
    - b. Mock-up displays of the key internal units. These could be used to provide clearer understanding of the operation of selectors, column splits, and comparing units.
    - c. Displays of simple control panel problems along with a description of the problem, control panel diagrams, and planning charts to aid the student in relating the elements of the machines
    - d. Demonstration of the internal parts of the machines by the manufacturer's representative or customer engineer will be helpful in clarifying internal operation of the machines

2. Laboratory Projects
    a. Students will turn in schematic diagrams of the various operating units of the machine. For example: reading unit, pilot selector, comparing unit
    b. Laboratory report - recording the problem: card columns to be read, nature of the data, functions to be performed, where results are to be punched or printed

DIVISION II - Programming the Interpreter

A. Units of Instruction - 3 Hours
    1. Basic principles of interpreter functions
        a. Review of the interpreter programming
        b. The interpreter control panel
        c. Review and discussion of the internal units of the interpreter
    2. Programming the various interpreter functions
        a. Straight interpreting
        b. Interpreting with card selection
        c. Interpreting with class selection
        d. Interpreting with field selection
        e. Interpreting with zero elimination

B. Laboratory Projects - 2 Hours
    1. Demonstrations of program planning and programming of the various interpreter functions
    2. Programming problems requiring planning charts, wiring diagrams, and interpreted cards
        a. Straight interpreting
        b. Card selection
        c. Class selection
        d. Field selection
        e. Zero elimination

DIVISION III - Programming the Reproducer

A. Units of Instruction - 3 Hours
    1. Basic principles of reproducer programming
        a. Review of the reproducer functions
        b. The reproducer control panel
        c. Review and discussion of the internal units of the reproducer
        d. Problem analysis and program planning

2. Programming and setup of the various reproducer functions
    a. Gangpunching and verifying
    b. Reproducing
    c. Summary punching
    d. Mark sensing
    e. Special functions

B. Laboratory Projects - 5 Hours
1. Demonstrations of program planning and programming of the various reproducer functions
2. Programming problems requiring planning charts, wiring diagrams, and the cards produced
    a. Gangpunching and verifying
    b. Interspersed gangpunching and verifying
    c. Straight reproducing and verifying
    d. Selective reproducing and verifying
    e. Summary punching
    f. Special functions and devices

DIVISION IV - Programming the collator

A. Units of Instruction - 6 Hours
1. Basic principles of collator programming
    a. Review of the collator functions
    b. The collator control panel
    c. Review and discussion of the internal units of the collator
    d. Collator problem analysis and program planning
2. Programming of the various collator functions
    a. Sequence checking
    b. Selecting
    c. Merging
    d. Merging with selection
    e. Matching
    f. Special functions and devices

B. Laboratory Projects - 4 Hours
1. Displays and demonstrations
    a. Displays of schematics of the collator with planning charts for the various applications
    b. Demonstrations of the program planning and programming of the various machine functions
2. Programming projects requiring planning charts, wiring diagrams, and resulting card decks
    a. Sequence checking
    b. Selecting X cards
    c. Selecting the last card of a group
    d. Selecting the first card of a group

- e. Selecting zero balance cards
- f. Selecting cards by a control number
- g. Selecting cards between two control numbers
- h. Merging
- i. Merging with selection
- j. Inserting cards behind specific groups
- k. Mixed merging
- l. Merging or matching by a range of numbers
- m. Inserting a predetermined number of cards ahead of or behind each master card
- n. Matching
- o. Matching card-for-card
- p. Special functions and devices

DIVISION V - Programming the Accounting Machine (Part 1)

- A. Units of Instruction - 9 Hours
  - 1. Basic principles of accounting machine programming
    - a. Review of the accounting machine functions
    - b. The accounting machine control panel
    - c. Review and discussion of the internal and functional units of the accounting machine
    - d. Problem analysis and program planning for the accounting machine
  - 2. Programming and setup of the following accounting machine functions and applications
    - a. Detail printing (listing)
    - b. Program control
    - c. Addition and subtraction
    - d. Group printing and group indication
    - e. Selective printing
    - f. Summary punching
- B. Laboratory Projects - 6 Hours
  - 1. Displays and demonstrations
    - a. Displays of input cards, problem analysis, planning charts, printed reports or documents, and summary punched cards which are illustrative of the machine functions covered in this division.
    - b. Demonstrations of program analysis, planning and programming of the functions to be programmed by the students.
  - 2. Programming projects requiring planning charts, wiring diagrams, and resulting reports or summary punched cards
    - a. Listing or detail printing
    - b. Listing with addition
    - c. Listing with addition and subtraction
    - d. Listing with totals by minor, intermediate and major classifications

- e. Group printed or tabulated report with addition and subtraction
- f. Group printed or tabulated report with totals by minor, intermediate, and major classifications
- g. Report with summary punched balance cards
- h. Summary punching with control identification of negative balances

DIVISION VI - Programming The Accounting Machine (Part 2)

- A. Units of Instruction - 7 Hours
  - 1. Programming and setup of the following accounting machine functions and applications
    - a. Setup change or alteration
    - b. Crossfooting
    - c. Recognizing negative balances
    - d. Progressive totals
    - e. Special programming
    - f. Form control - skipping and overflow
    - g. Multiple line printing
- B. Laboratory Projects - 7 Hours
  - 1. Displays and demonstrations
    - a. Displays of input cards, problem analysis, planning charts, and printed reports and documents illustrating the problems to be programmed in this division
    - b. Demonstrations of program analysis, planning and programming for the types of problems to be assigned in this division.
  - 2. Laboratory projects requiring planning charts, wiring diagrams, and resulting reports or documents
    - a. Use of setup change switch to produce both a listed and a tabulated report from one control panel.
    - b. Report with crossfooted totals
    - c. Report requiring field selection between cards, numeric field selection and alphabetic field selection
    - d. Report requiring class selection of the cards - printing in several locations from the same card field
    - e. Listed report requiring progressive totals for card of a minor classification
    - f. Listed report requiring distribution of amounts to different printing positions and counters on the basis of control digits (digit selection)

- g. Problem involving group indication in a listed report utilizing either counters, selectors and/or hammerlock control
- h. Problem involving multiple control x selection of printing position and counters - a statement comparing current with previous operations such as a comparative sales analysis by commodity, salesman, or customer
- i. Short form skipping problem such as label preparation
- j. Sales invoice or customer statement preparation problem
- k. Inverted form problem - payroll check and remittance statement
- l. Aging of accounts receivable report problem
- m. A labeling, listing, or invoicing problem utilizing (MLP) multiple line printing

DIVISION VII - Programming the Calculator (Part 1)

- A. Units of Instruction - 9 Hours
  - 1. Basic principles of calculator programming
    - a. Review of the calculator functions
    - b. The calculator control panel
    - c. Review and discussion of the internal and functional units of the calculator
    - d. Problem analysis and program planning for the calculator
  - 2. Programming and setup of the following calculating machine functions and applications
    - a. Crossfooting
    - b. Balance conversion
    - c. Counter transfer of negative numbers
    - d. Multiplication
    - e. Multiplication and crossfooting with decimal alignment
    - f. Division
    - g. Simultaneous division and multiplication
    - h. Selection
    - i. Group multiplication or division
    - j. Group multiplication with decimal accumulation
    - k. Summary punching
    - l. Verification of basic multiplication
    - m. Verification of basic division

B. Laboratory Projects - 6 Hours
  1. Displays and demonstrations
    a. Displays input and output cards, problem analysis and planning charts for the types of problems covered in this section
    b. Demonstrations of the program analysis, planning, and programming for types of problems to be assigned in this section
  2. Laboratory projects requiring planning charts, wiring, diagrams, resulting cards, and listings of the test decks
    a. Crossfooting---burden amount + labor amount = total cost
    b. Multiple field crossfooting---miscellaneous earnings + regular earnings + extra shift earnings + overtime premium earnings = gross earnings
    c. Balance conversion---current budget amount - current expense amount = current over or under budget
    d. Crossfooting with function selection---opening balance and receipts - withdrawals ± transfers and adjustments = stock balance
    e. Multiplication---unit price x quantity = gross sales
    f. Multiplication---regular hours x regular rate = regular earnings (rounded to nearest cent)
    g. Multiplication and crossfooting---quantity ordered x hours per 100 + setup hours + transit = load hours
    h. Group multiplication---unit price (contained in lead master card for the group) x quantity = gross sales
    i. Group multiplication with decimal accumulation---labor rate (2 decimals, contained in lead master card for the group) x man hours (1 decimal) = labor amount (2 decimals)
    j. Division---net earnings ÷ hours worked = average hourly rate (rounded to nearest cent)
    k. Division---value ÷ quantity = unit price (rounded to the nearest cent)
    l. Division and crossfooting---net sales - cost ÷ cost = percent of profit (rounded to the nearest tenth of one percent)
    m. Division and multiplication---pieces ÷ (hours x pieces per hour) = percent of efficiency (half adjust to the nearest tenth of one percent)
    n. Summary punching---labor rate x quantity claimed = labor amount; first labor amount + second labor amount, etc. = sum of labor amounts

o. Verification of multiplication---quantity x unit price - gross sales - 1 = check (punch an x control punch if in error)
p. Verification of division---(average hourly rate x hours worked) + net earnings + (.5 x hours worked) = check (punch a control x for all error cards)

TEXTS AND REFERENCES

MANUALS AND BOOKLETS --

INTERNATIONAL BUSINESS MACHINES -

Functional Wiring Principles
Manual of Operation - Interpreters
Reference Manual - Reproducing Punches
Reference Manual - Collators
Manual of Operation - Accounting Machine
Practice Problems for Customer Training - Accounting Machine
Reference Manual - Calculating Punch
Practice Problems - Calculating Punch

PROGRAMMING COMPUTERS FOR BUSINESS

D.P. 61

HOURS REQUIRED

Class, 3; Laboratory, 2

DESCRIPTION

A basic course in programming of electronic digital computers for those who plan to be programmers or those whose work may be closely related to computer applications in business and industry. Course covers problems of data processing, characteristics of computers, and computer programming or coding. Laboratory experience is provided on the IBM 1620 computer and 1401 computer.

MAJOR DIVISIONS

I. Introduction to Computers
II. Computer Words
III. Coding Fundamentals
IV. Console Operations
V. Flow Charting
VI. Loops and Looping
VII. Address Computation
VIII. Subroutines
IX. Program Checkout
X. 1620 Machine Language
XI. FORTRAN Programming
XII. 1401 Machine Language

DIVISION I - Introduction to Computers

A. Development
    1. Babbages' Calculating Machines
        a. Difference engine
        b. Analytical engine
        c. Mechanical design

B. Uses
    1. Business
        a. Payrolls
        b. Inventory control
        c. Management decisions

    2. Scientific
        a. Design
        b. Simulation
        c. Numerical solutions

DIVISION VI - Loops in Computing

- A. Parts of a loop
    - 1. Initialize
    - 2. Main body
    - 3. Update addresses
    - 4. Test for completion
- B. Techniques for programming loops
    - 1. Incrementing value of variables
    - 2. Table of values
    - 3. Overflow use
    - 4. Counting up
    - 5. Control word

DIVISION VII - Address Computation

DIVISION VIII - Subroutines

- A. Introduction
    - 1. Need for
    - 2. Open type
    - 3. Closed type
- B. Linkage
    - 1. Return address command
    - 2. Unconditional command
- C. Calling sequences
- D. Subroutine libraries

DIVISION IX - Program Check Out

DIVISION X - 1620 Machine Language

- A. Description of 1620 memory
- B. Registers
- C. Instructions

DIVISIONS XI - FORTRAN Programming

DIVISION XII - 1401 Machine Language

- A. Description of 1401 memory
- B. Registers
- C. Instructions

DIVISION II - Word Structure

- A. Computers in general
  - 1. Accuracy
  - 2. Fixed word length
  - 3. Variable word length
- B. CYBERNAC
  - 1. Fixed word length
  - 2. Hexadecimal representation
- C. Data words
  - 1. Sign control
  - 2, Significant bits
- D. Instruction words
  - 1. Order portion
  - 2. Track portion
  - 3. Sector portion
- E. Address conversion
  - 1. From hexadecimal to decimal
  - 2. From decimal to hexadecimal

DIVISION III - Coding Fundamentals

- A. Memory identification
- B. Instruction format
- C. Commands (basic)
- D. Examples
  - 1. Adding two numbers
  - 2. Calculation of absolute value
  - 3. Multiplying two numbers
  - 4. Dividing two numbers
  - 5. Determining larger of two numbers
  - 6. Shifting numbers

DIVISION IV - Console Operation

DIVISION V - Flow Charting

- A. Introduction
- B. Flow charting notation
  - 1. Function box
  - 2. Decision box
  - 3. Connector
  - 4. Input box
  - 5. Direction of flow indication
  - 6. Start and stop box

PROGRAMMING COMPUTERS FOR BUSINESS

D.P. 62

HOURS REQUIRED

Class, 3; Laboratory, 2

DESCRIPTION

Advanced course in electronic digital computer programming including advanced techniques, symbolic and macro programming and program timing and planning. Principles of magnetic tape and random access programming. Accounting, auditing and data protection included in computer applications. Laboratory work on IBM 1401 digital computer.

MAJOR DIVISIONS

I. Instructions
II. Symbolic Programming
III. Macro Programming
IV. Programming a Tape System
V. Programming a Random Access Device
VI. Job Timing
VII. Program Testing

DIVISION I - Instructions

A. Magnetic core storage
B. Solid state circuitry
C. Advanced design
D. Data flow
E. Parity checking
F. Word mark
G. Instruction format
H. Operation codes
I. Addressing
J. Clear operations
K. Word mark operations
L. Move operations
M. Load operations
N. Logic operations

DIVISION II - Symbolic Programming

A. Area definition
B. S.P.S. instructions
C. Processor program
D. Processor control operations
E. Comments card
F. Condensing card
G. Editing
H. Input-output operations
I. Combination instructions
J. Document control instructions

DIVISION III - Macro Programming

A. Macro-instruction concept
B. Medium level programming system
C. Use of library macros
D. Creation of macros
E. Macro generators

DIVISION IV - Programming a Tape System

A. Magnetic tape characteristics
B. Magnetic tape file organization
C. Instructions
D. E.O.J., E.O.F., E.O.R. routines
E. File maintenance

DIVISION V - Programming a Random Access Device

A. Random access characteristics
B. Random access file organization
C. Instructions
D. File loading routine
E. File dumpting procedures
F. Timing random access operations
G. Inquiry station

DIVISION VI - Job Timing

A. Gross timing
B. Computing document throughout for the card system
C. Timing tape oriented job
D. Timing individual program steps

DIVISION VII - program Testing

A. Program listings
B. Test data
C. Operating instructions
D. Checklists
E. Pre-calculated answers
F. Desk checking
G. Debugging techniques
H. Test team organization

DIVISION VIII - Autocoder

DIVISION IX - Disk Autocoder

COMPUTER PROGRAMMING SYSTEMS

D.P. 63

HOURS REQUIRED

Class 3 per week, . lab 2 per week

DESCRIPTION AND OBJECTIVES:

To provide a working familiarity with and appreciation of programming systems for medium and large scale digital computers. Emphasis is placed on the higher level programming languages (FORTRAN & COBOL) and their integration into the total operating system. Where hardware references are necessary, the IBM 1401 or 1620 DPS will be used. Prerequisite: D.P. 62 or equivalent.

MAJOR DIVISION		Class Hours
I.	Assembly Systems	3
II.	Macro Systems	3
III.	Input/Output Control Systems	6
IV.	Random Access	3
V.	Monitor Systems	6
VI.	FORTRAN	9
VII.	COBOL	9
VIII.	Report Program Generations	3
IX.	Sort Systems	3
X.	Utility Programs	3
XI.	Review and Final Exam	3

DIVISION I - Assembly Systems

A. 1401 SPS System
B. Language specification
C. Language implementation

DIVISION II - Macro Systems

A. Autocoder statements
B. 1620 SPS System
C. Generation of macros
D. Student program

DIVISION III - Input/Output Control Systems

A. For overlapped computers
B. For non-overlapped computers
C. File and channel schedulers
D. IOCS macro statements
E. Labeling
F. Subroutine generation
G. IOCS inclusion in Object Program

DIVISION IV - Random Access Storage

A. Random access devices
B. Disk organization and structure
C. File organization

DIVISION V - Monitors

A. Importance of Monitors
B. Design of monitors
C. Function of monitors
D. Use of monitors

DIVISION VI - FORTRAN

A. Input/output statements
B. Arithmetic statements
C. Control statements
D. Specification statements
E. Student program

DIVISION VII - COBOL

A. Data division
B. Environment division
C. Identification division
D. Procedure division
E. Student program

DIVISION VIII - Report Program Generations

A. Introduction to RPG
B. Problem oriented languages
C. Tabular languages

DIVISION IX.- Sort Systems

A. Design of
B. Timing of
C. Use of
D. Modification of standard sort systems

DIVISION XI - Utility Systems and Simulators

A. Standard packages
B. Types of language simulation
C. Types of machine simulation

TEXT:

COMPUTER PROGRAMMING SYSTEMS - Fisher, Swindle

ORANGE COAST COLLEGE

PRE-SCIENCE/ENGINEERING DATA PROCESSING

Hours Per Week: 10 lecture: 10 laboratory Units of Credit: 6

Department and Number: Data Processing 65

For Whom Is Course Intended:
For recent high-school graduates who intend to attend a four-year college in preparation for a bachelor's degree and for Orange Coast College students who whould take a survey course in data processing as part of a terminal or transfer program.

Prerequisite:
Two years of high school algebra; high school trigonometry.

Texts:
IBM Manual, A Fortran Primer with Business Administration Exercises
Germain, Clarence B., Programming the IBM 1620, 2nd volume; prentice-Hall,1965

Course Description:
This is an eight-week, four-hour per day course including both lecture and laboratory sessions in electronic data processing.

Course Objectives:

1. To provide a basic understanding of data processing in general and specifically in electronic data processing to the college-bound high-school graduate.

2. To develop the computer programming skills required by four-year institutions for bachelor's degrees in science and engineering fields.

3. To meet the course requirements in computer programming required by many four-year institutions for bachelor's degrees in science and engineering fields.

4. To provide a summer course in data processing for Orange Coast students majoring in business, science or engineering who need such a course as a suggested elective or as a requirement for their program. This course may be taken in lieu of Data Processing 1 and Data Processing 61 for these purposes.

COURSE OUTLINE:

Week 1: Intro to Computer Programming

1. The Unit Record
2. Cybernac
3. Stored Programs
4. Block Programming
5. Registers, Data flow

Week 2: General Data Processing

1. History of D.P.
2. Functions of D.P.
3. Unit-Record of D.P.
4. Difference between Bus. & Sci.

Week 3: Introduction IBM 1620

1. Conversion to 1620
2. Core Position Addressability
3. Decrementation of Registers
4. Basic I-0 Instructions, Transfer Data, Arithmetic Instructions

Week 4: Computer Programming Continued

1. Editing of Output
2. Intro to SPS
3. Subroutines
4. Numerical Analysis Approach to Root Solution or Business Application of Payroll Problem

Week 5: Symbolic and Macro Programming

1. SPS
2. Floating Point Arithmetic on 1620
3. Synthetic Division

Week 6: Intro to Fortran

1. Input/Output
2. Arith. Ops
3. Matrix Operation

Week 7: Fortran Continued

1. Systems of Equations
2. Linear Programming

Week 8: Fortran Applications

1. Linear Programming
2. Business & Other "Non Math" Applications

COMPUTER-MANAGEMENT PRINCIPLES

D.P. 66

HOURS REQUIRED

Class, 3; Laboratory, 0

DESCRIPTION AND OBJECTIVES

An application of basic management principles to the computer activity within the firm. Examination of the computer as a tool in accomplishing the management functions of planning, communications and control. The computer as a part of the firm to be managed.

MAJOR DIVISIONS

I. Introduction
II. Review of Management Principles
III. Evolving Needs of the Firm
IV. History and Development of the Computer
V. The Computer in Management Functions
VI. Industry Needs and Outlook
VII. Survey of Current Literature in Computer Management

DIVISION I - Introduction

A. Units of Instruction - 3 Hours

1. Overview of the course
    A. Origin
    B. Distribution of syllabus
2. Definition of terms
    A. Who or What is "Management", "Executive", "Computer", EDP, ADP, IDP, "Staff".
3. Overall impact of the computer
    A. Discussion of article "Computer: New Tool, New World."

DIVISION II - Review of Management Principles

A. Units of Instruction - 6 Hours

1. Traditional Functions of Management
    A. Planning
    B. Organizing
    C. Staffing
    D. Directing
    E. Controlling
2. Other Useful Concepts
    A. Babbage & Tayler's Methodology
    B. Drucker - "Management by Objective"

- C. Bernard's "First Function of the Executive"
- D. Martindell - "Unflinching Control"
- E. Phillippe's concept of a "Business Intelligence System"
- F. Training as an Executive Function
- G. Universality of Management
- H. The Total Systems Concept

3. Functions of Management - Redefined
    - A. Jarome's system for executive control
        - (1) Planning
        - (2) Organizing
        - (3) Communications

DIVISION III - Needs of the Firm

A. Units of Instruction - 5 Hours

1. Role of communications in control
    - A. Feedback
2. Testing planning decisions
    - A. Need to increase probability of satisfactory outcome
3. Communication and decentralization
    - A. Generation of middle-management
4. Communication and recentralization
    - A. Displacement of middle-management
5. The computer
    - A. As helping satisfy needs
    - B. As an additional problem area
        - (1) Need for standards
        - (2) Automation and human displacement

DIVISION IV - History & Development of the Computer

A. Units of Instruction - 4 Hours

1. Key historic benchmarks
    - A. Development of number systems
    - B. Number theory
    - C. Emergence of logic
        - (1) Contributers
    - D. Mechanization
        - (1) Logic Machines
        - (2) Calculaters
    - E. Automation
        - (1) Babbage
        - (2) Hollerith
        - (3) ENIAC
2. Role of communications
    - A. The Arabs
    - B. The Printing Press
3. Role of Standards
    - A. Effect on number system development
    - B. Effect on early data equipment
    - C. Acurrent industry need
        - (1) H.R. #858 of 88th Congress

- 4. Decade of applications
  - A. Outlook of user, rather than developer

DIVISION V - The Computer in Management Functions

- A. Units of Instruction - 15 Hours
  - 1. The computer - A part of the firm to be managed
    - A. Discussion of article "Managing the Data Processing Operation"
  - 2. Planning & Decision Making
    - A. The feasibility study
      - (1) Composition of the study group
      - (2) Purpose of the study
      - (3) Management control of the study group
      - (4) Recognition of management objectives
    - B. Operations Research in Business
      - (1) Definitions
      - (2) History and methodology
    - C. Other Staff Activities
  - 3. Organization
    - A. Organizational position of the computer activity
      - (1) A function of initial objectives
  - 4. Communications
    - A. The key to other executive functions
    - B. Communication flow in the firm
      - (1) Centralized firm
      - (2) Decentralized firm
    - C. IDP and management information
      - (1) The feedback loop
      - (2) Data collection and validation
    - D. Communication, the computer, and recentralization
      - (1) Article "Management Information Systems"
  - 5. Control
    - A. Computer control of other activities
    - B. Control of the computer activity
      - (1) Auditing computer-controlled systems
      - (2) Documentation
    - C. Standards
      - (1) In the firm
      - (2) In the industry

DIVISION VI - Industry Needs and Outlook

- A. Units of Instruction - 8 Hours
  - 1. Limiting factors in the industry
    - a. Industry standards
      - (1) Role of the federal government
    - b. Capability exceeds utilization
  - 2. Decade of applications
    - a. Internal revenue service
    - b. Libraries - The MEDLAR Story
    - c. Banking - Improved Cash Management

- d. Future Markets
    - (1) Independent retailers
- e. Education
    - (1) Importance to industry
    - (2) Executive simulation - case study
- f. Social implications

DIVISION VII - Survey of Current Literature

A. Units of Instruction - 3 Hours

1. Evaluation of current publications in the field
2. Examination of periodicals as source material
3. The call for computer management

DATA PROCESSING WORK EXPERIENCE

D.P. 82

HOURS REQUIRED

Class, 1; Employment 15

DESCRIPTION AND OBJECTIVES

Provides actual work experience for students in a data processing installation and an opportunity for the practical application of the skills and knowledge previously learned. Class sessions include discussion of specific problems encountered by the employed student. Prerequisite: Completion of basic courses in the data processing curriculum.

MAJOR DIVISIONS

I. Problems of Handling and Processing Large Quantities of Cards
II. Accessory Equipment to Assist
III. Equipment Maintenance Problems
IV. Problems of Working A Multi-Shift Basis
V. Communications with Fellow Workers
VI. Data Processing Installation Supervision
VII. Problems Related to Different Sized Installations
VIII. Special Devices Available for Equipment

DIVISION I - Problems of Handling and Processing Large Quantities of Cards

A. Dangers involved
B. Techniques

DIVISION II - Accessory Equipment to Assist

A. Equipment catalogs

DIVISION III - Equipment Maintenance Problems

A. Clearing card jams
B. Operator responsibility
C. Customer Engineer responsibility
D. Demonstration
E. Safety precautions
F. Invite Customer Engineer for discussion

DIVISION IV - Problems of Working a Multi-Shift Basis

A. Scheduling of machines
B. Planning new work
C. Inter-shift communications
D. Cost factors

DIVISION V - Communications with Fellow Workers

A. Formal written procedures, value of
B. Verbal vs. written communications
C. Personnel relations

DIVISION VI - Data Processing Installation Supervision

A. Scheduling of jobs
B. Scheduling of personnel
C. Scheduling of machines
D. Relations with personnel outside of the installation
E. Assignment of job priorities

DIVISION VII - Problems Related to Different Sized Installations

A. The large installation

    1. Personnel capabilities
    2. Job classifications
    3. Advantages to the trainee
    4. Disadvantages to the trainee

B. The small installation

    1. Personnel capabilities
    2. Job classifications
    3. Advantages to the trainee
    4. Disadvantages to the trainee

DIVISION VIII - Special Devices Available for Equipment

A. Specialized tasks
B. Economic factors
C. Examples

In addition, the students will write a section for the procedures manual of the company employing them. These will be presented and discussed in class. It is intended that these projects will be of actual value to the employer as well as the student, and a copy will be submitted to the employer.

DATA PROCESSING WORK EXPERIENCE

D.P. 83

HOURS REQUIRED

Class 1; Employment 15

DESCRIPTION AND OBJECTIVES

Continuation of Data Processing Work Experience 82
Prerequisite: D.P. 82

MAJOR DIVISIONS

I. Computer Scheduling Techniques
II. Problems of the Programmer
III. The use of Magnetic Tape
IV. Employment Possibilities
V. Techniques of Applying for a Job

DIVISION I - Computer Scheduling Techniques

A. Work flow
B. Status board
C. Data identification

DIVISION II - Problems of the Programmer

A. No contact with the computer
B. Coordination with other programmers
C. Receiving information from the Systems Department
D. Program maintenance

DIVISION III - The use of Magnetic Tape

A. Operating techniques
B. Precautions
C. Tape library

DIVISION IV - Employment Possibilities

A. Job classifications
B. Salary scales
C. Trainee requirements

DIVISION V - Techniques of Applying for a Job

A. Sources of job openings
B. Research about the company
C. Personal history
D. The interview

In addition, the students will write a section for the procedures manual of the company employing them. These will be presented and discussed in class. It is intended that these projects will be of actual value to the employer as well as the student, and a copy be submitted to the employer.

MATHEMATICS 7

Computer Programming for Engineering, Mathematics and Science

HOURS REQUIRED

Class 3; Laboratory 2

DESCRIPTION

Basic programming of electronic digital computers with emphasis on applications in engineering, mathematics and science. Machine language, symbolic and FORTRAN programming. Numerical techniques including intergration, matrix inversion and Newtonian approximations. Lab work on IBM 1620 digital computer.

PREREQUISITES

Grade of "C" or better in Math. 1A or Math. 44.

MAJOR DIVISIONS

I. Computing Fundamentals
II. Basic 1620 DPS Concepts
III. Data Transmission
IV. Block Diagramming and Flowcharting
V. Arithmetic Instructions
VI. The Symbolic Programming System
VII. Branching Techniques
VIII. Finding Roots of Equations
IX. Floating Point Instructions
X. FORTRAN Programming System
XI. Evaluating Integrals
XII. Solving Systems of Equations
XIII. FORTRAN IV
XIV. Disk Instructions and IOCS

DIVISION I - Computing Fundamentals

A. What is a computer
B. The stored program
C. Core and card representation
D. Computer configuration registers
E. I and E cycles
F. Fields, records and signed data

DIVISION II - Basic 1620 DPS Concepts

A. Instruction format
B. Numeric and alphameric data
C. Magnetic core storage
D. Registers in the 1620

DIVISION III - Data Transmission

A. Input-Output instructions
B. Internal data transmission instructions

DIVISION IV - Block Diagramming and Flowcharting

A. Purpose of the block diagram
B. Purpose of the flowchart
C. Symbols used in block diagramming and flowcharting
D. Block diagramming and the programmer
E. Flowcharting and the System

DIVISION V - Arithmetic Instructions

A. Add and multiply tables
B. How addition and multiplication accomplished
C. Division

DIVISION VI - The Symbolic Programming System

A. Why a SPS system
B. Operation of the Assembly System
C. Imperatives
D. Declaratives
E. Processor control statements

DIVISION VII - Branching Techniques

A. Standard branch instructions
B. Indirect addressing techniques
C. Modification of Op codes
D. Programmed switches
E. Sense switches
F. Linking subroutines

DIVISION VIII - Finding Roots of Equations

A. Solving the General Quadratic
B. Newton-Raphson iteration
C. Graphical techniques
D. Method of Regula Falsi

DIVISION IX - Floating Point Instructions

A. Floating point arithmetic

- B. Floating point subroutines
- C. Macro concept
- D. Expanded mantissa lengths

DIVISIONS X - FORTRAN Programming System

- A. Why FORTRAN
- B. Input-Output formats and instructions
- C. Arithmetic operations
- D. The Compiler
- E. IF and GO TO statements
- F. Do loops
- G. FORTRAN subroutines

DIVISIONS XI - Evaluating Integrals

- A. Newton-Cotes formulas
- B. Monte-Carlo techniques

DIVISIONS XII - Solving Systems of Equations

- A. Gauss elimination
- B. Gauss-Seidel
- C. Matrices
- D. Crout reduction

DIVISION XIII - FORTRAN IV

- A. Logical operations
- B. Input-Output differences
- C. Complex operations

DIVISIONS XIV - Disk instructions and IOCS

- A. Physical characteristics and operations
- B. Supervisor
- C. Systems output format
- D. SPS disk instructions
- E. Introduction to IOCS

Laboratory Exercises

3 Machine language
3 Symbolic Programming System
4 FORTRAN Programming System

DATA PROCESSING MATHEMATICS

MATHEMATICS 33

HOURS REQUIRED

Class, 3

DESCRIPTION

A prescribed course for the Business Data Processing Curriculum. Basic logic, the number system, algebra with emphasis on problem solving, computation with logarithms and with numbers in bases other than ten, Boolean Algebra, Matrix Algebra, Algebra of Linear Programming.

PREREQUISITES

Two years high school algebra or Math D. A grade of C or better is required.

MAJOR DIVISION.

I. Set and Set Operations
II. Sets and Logical Statements
III. The Logic of Statements
IV. Boolean Algebra and Switching
V. Binary, Octal, Hexadecimal Number System
VI. Algebra, Analytic Geometry and Functions
VII. Functions and Managerial Planning
VIII. Exponential and Logarithmic Functions
IX. Mathematics of Investment and Finance
X. Fundamentals of Linear Programming
XI. The Algebra of Linear Programming
XII. Computational Methods of Lindear Programming
XIII. Differential Calculus

DIVISION I - Set and Set Operations

A. Notation of Sets
B. Equality and Subsets
C. Basic Operations
D. Abstract Laws of Set Operations

DIVISION II - Sets and Logical Statements

DIVISION III - The Logic of Statements

DIVISION IV - Boolean Algebra and Switching

DIVISION V - Binary, Octal, Hexadecimal Number System

DIVISION VI - Algebra, Analytic Geometry and Functions

A. Algebraic Equations
B. Algebraic Operations
C. Quadratic Equations
D. Analytic Geometry
E. Graphing of Linear and Quadratic Functions
F. Slope
G. Average Rate of Change

DIVISION VII - Fundtions and Managerial Planning

A. Functions and Their Inverses
B. Linear Functions:Prediction Control
C. Forecasting
D. Break-even Analysis
E. Applications of Quadratic Functions
F. Maximum and Minimum

DIVISION VIII - Exponential and Logarithmic Functions

DIVISION IX - Mathematics of Investment and Finance

DIVISION X - Fundamentals of Linear Programming

A. Inequalities and Their Graphs
B. Maximizing Profit and Minimizing Costs
C. Linear Programming in Two and Three Unknowns

DIVISION XI - The Algebra of Linear Programming

A. Vector Algebra and Application
B. Matrix Algebra and Application

DIVISION XII - Computational Methods of Linear Programming

A. The Simplex Method
B. The Transportation Method

DIVISION XIII.- Differential Calculus

A. Limit Concept
B. Continuity of a Function
C. Derivative
D. Maximum and Minimum Values of a Function

TEXTBOOK: Applied Mathematics-An Introduction by Chris A. Theodore